Healthy, wealthy and wise

Investigating the application of health economics in workplace health promotion: the economic evaluation of Healthy@Work

by

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B.N.R.N. (Hons)

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy (Medical Research)

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Declaration of originality

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Statement of co-authorship

This thesis includes papers for which Siyan Baxter (SB) is first but not sole author. SB led the work in developing and conceptualising the papers, implementing the analyses and writing the manuscripts under the primary supervision of Andrew Palmer (AP) and supervisors Kristy Sanderson (KS) and Alison Venn (AV). Throughout the work presented herein she was assisted by co-authors from both research and policy alliances. Detailed below are the contributions of SB and each of her co-authors for each respective paper.

1. The paper reported in Chapter 2:

Baxter S, Sanderson K, Venn AJ, Blizzard CL, Palmer AJ. "The Relationship between Return on Investment and Quality of Study Methodology in Workplace Health Promotion Programs" *American Journal of Health Promotion* July 2014; 28(6): 347-363.

- SB developed the protocol following Campbell Cochrane Economic Methods Group and the PRISMA Statement. SB performed the data collection, extraction and statistical analysis. The analysis was conducted under the supervision of Leigh Blizzard (LB). SB drafted the manuscript and coordinated revisions and submission.
- AP was involved in the initial development and drafting of the protocol, and reviewed the extraction of data. AP acted as second reviewer for consensus of methodological quality scores. AP assisted in the interpretation of the results and assisted with manuscript revisions.
- KS was involved in conceptualising the paper, helped with interpretation of the results and assisted with manuscript revisions.
- LB provided statistical programs, guidance and supervision for statistical analyses, and was involved in the critical revision of the manuscript.
- AV was involved in the conceptualisation and critical revision of the protocol and the manuscript.

2. The paper reported in Chapter 3:

Baxter S, Campbell S, Sanderson K, Cazaly C. Venn AJ, Owen C, Palmer AJ. "Development of the Workplace Health Savings Calculator; a Practical Tool to Measure Economic Impact from Reduced Absenteeism and Staff Turnover in Workplace Health Promotion" *BMC Research Notes - Technical Note* Accepted for publication

- SB undertook an internship with the Tasmanian Department of Health and Human Services (DHHS) as part of the *partnering*Healthy@Work (*p*H@W) agreement between researchers and policy makers. SB developed the tool, conceptualised the paper, interpreted the data and wrote the manuscript. SB coordinated revisions and submission.
- Sharon Campbell (SC) approached the research team under the *p*H@W agreement with the concept of developing an evidence-based resource within the DHHS Healthy Worker Initiative policy team. She appropriated the tool for policy, obtained the user data from federal government platform operators and contributed to revisions of the draft and final manuscript.
- KS advised on the data analysis and development of the tool and contributed to revisions of the draft and final manuscript.
- Carl Cazaly (CC) assisted the development of the resource to the federal level and contributed to the draft and revisions to final manuscript.
- AV initiated the research-policy alliance and contributed to the draft and revisions to final manuscript.
- Carole Owen (CO) led the research-policy alliance within the DHHS as supervisor of my internship, contributed and approved the manuscript.
- AP advised on the data analysis and development of the tool and contributed to revisions of the draft and final manuscript.

3. The paper reported in Chapter 4:

Baxter S, Sanderson K, Venn AJ, Otahal P, Palmer AJ. "Construct validity of SF-6D health state utility values in an employed population" *Quality of Life Research* July 2015; 24(4): 851-870 (First published online on the 11th of October, 2014).

- SB conceptualised the paper, applied for and granted the Individual Deed of Licence to obtain Household Income and Labour Dynamics of Australia (HILDA) dataset, performed the analyses and wrote the manuscript. SB coordinated revisions and submission.
- KS assisted in the process of analysis interpretation and manuscript revisions.
- AV assisted in the interpretation and manuscript revisions.
- PO provided statistical guidance and supervision for the analyses, and was involved in the critical revision of the methods within the manuscript.
- AP assisted in the conceptualisation, interpretation and manuscript revisions.

4. The paper reported in Chapter 5:

Baxter S, Jose K, Teale B, Sanderson K, Venn AJ, Otahal P, Palmer AJ. "Evaluating the health and economic impact of a Government workplace health and wellbeing program: a cost consequence analysis of Healthy@Work (H@W)" This manuscript has been submitted to the *American Journal of Health Promotion* following recent receipt of pre-submission approval.

- SB developed the economic evaluation plan, conceptualised the paper, performed independent ranking of organisational capacity, conducted the economic evaluation, wrote the manuscript and coordinated revisions and submission.
- Kim Jose (KJ) assisted in the mixed methods approach to develop the organisational capacity measure, performed independent ranking of organisational capacity and contributed to revisions in the manuscript.
- Brook Teale (BT) conceptualised the H@W project, provided H@W budget data, policy documents and guidance, and contributed to revisions in the manuscript.
- KS developed the *partnering*Healthy@Work survey for data collection, assisted in conceptualising the paper and revising the manuscript.
- AV developed the *partnering*Healthy@Work survey for data collection, assisted in in conceptualising the paper and revising the manuscript.
- PO provided statistical guidance and supervision for the analyses, and was involved in the critical revision of the methods within the manuscript.
- AP assisted with the conceptual economic evaluation plan, assisted in the economic evaluation and helped revise the manuscript.

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Statement of ethical conduct

The research associated with this thesis abides by the international and Australian codes on human and animal experimentation, the guidelines by the Australian Government's Office of the Gene Technology Regulator and the rulings of the Safety, Ethics and Institutional Biosafety Committees of the University.

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4 November, 2015

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A note for me from Naiya, May 2015

So to my darling Naiya, my beautiful girl ……. let's go outside and play ☺

Abstract

Workplace health promotion (WHP) describes any initiative carried out in the workplace to support and ultimately improve the health and wellbeing of people at work. Implementation of WHP is often unique to the organisation, and can include individual, social, cultural, environmental and political processes. Funding of WHP may necessitate an economic evaluation. The ideal evaluative method, however, is unclear. This thesis investigated the application of health economics in WHP by considering established guidelines and business needs to conduct an economic evaluation of an organisational approach to WHP in state government, Tasmania, Australia; Healthy@Work (2009-2012).

The first chapter is a review of the global WHP evidence. A quality-based systematic literature review identified currently used components of economic evaluations. It found that methodological quality of economic evaluations was generally low to moderate and that benefits were measured predominately by changes in absenteeism and healthcare costs. The review also provided a robust synthesis of return on investment, accounting for quality along with offering recommendations for improving the state of evidence in WHP.

From insights gained, a resource was then developed on behalf of a research-policy partnership. The second chapter describes the development of a workplace health savings calculator that is currently a national resource to assist employers at a business case level and is available in a WHP toolkit on the Australian federal government website.

Data sourced locally (Healthy@Work) and nationally (Household Income and Labour Dynamics of Australia; HILDA) were used in a further analysis to investigate the validity of health utility in the employee population. It demonstrated construct validity of a measure of health status (SF-6D) derived from health-related quality of life (SF-12v2), and recommended its use in economic evaluations. This finding closes the gap between evaluations in WHP and health economic guidelines.

Collectively these works helped identify measure and value what costs and benefits are involved in WHP. The final chapter applied this knowledge. An economic evaluation of Healthy@Work was conducted. Overall costs and impacts from health status, total lost productive time and healthcare utilisation were presented in a cost consequence analysis. There was no health status change found and inherent challenges for WHP when positioned within a public health paradigm were discussed.

This thesis presents a range of studies that add to the body of knowledge for conducting economic evaluations in workplace health promotion. It discusses economic forms and analytic methods in the pursuit of best fit for WHP.

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Publications

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Chapter 3:

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Manuscripts submitted to peer-reviewed journals

Chapter 5:

Baxter S, Jose K, Teale B, Sanderson K, Venn AJ, Otahal P, Palmer AJ. "Evaluating the health and economic impact of a Government workplace health and wellbeing program: a cost consequence analysis of Healthy@Work (H@W)" This manuscript has been submitted to the *American Journal of Health Promotion* following recent receipt of pre-submission approval.

Other publications

Policy resources developed from work arising out of the *p*H@W Pubic Sector Internship within the Tasmanian Department of Health and Human Services

1. The Healthy Workplace Resource Toolkit
   Chapter 3: How will a health and wellbeing program improve my bottom line?

2. Your Simple Guide to Workplace Health and Wellbeing: Building a successful health and wellbeing program in your workplace
   Chapter 3: Why invest in health and wellbeing?

Conference presentations arising from this work

Oral presentations (*presenter Baxter, S. unless otherwise specified)

2012 Population Health Congress 2012; "Population Health in a Changing World" Adelaide AUSTRALIA

"*A quality-based systematic review of the economic evidence for workplace health promotion*" 10-12 September

2013 *partnering*Healthy@Work Symposium; "Investing in workplace health promotion: What's the return?" Hobart AUSTRALIA

"*What return on investment can we expect? Evidence from a quality-based systematic review"* 22 March

2013 9th World Congress on Health Economics, International Health Economics Association (iHEA); "Celebrating Health Economics" Sydney AUSTRALIA

"*Economic evaluations of workplace health promotion: a quality-based systematic review*" 7-10 July

2014 21st Annual Conference of the International Society for Quality of life Research (ISOQOL); "Quality of Life: Advancing Measurement Science and transforming Healthcare" Berlin GERMANY

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Research report (65 minutes) "*Methodology and the Latest Reporting Standards for Economic Evaluations in Workplace Health Promotion: Evidence from the Baxter Review*" 30 March – 3 April

Poster presentations

2013 University of Tasmania, Graduate Research Conference, Hobart AUSTRALIA "*The Workplace Health Savings Calculator: an example of translational research through partnership*" 4 September *joint presentation by Baxter, S and Campbell, S

2014 6th Asia Pacific Conference of International Society of Pharmacoeconomics and Outcomes Research (ISPOR); "Patients: The Centre of Evolving Health Care in Asia-Pacific" Beijing CHINA "*Construct validity of SF-6D health state utility values in an employed population*" 6-9 September *presenter Palmer, A

Invited speaker presentations

2013 University of Tasmania, School of Medicine short course, "Rationing in the 21st century, the why, what and how of health economics" Hobart AUSTRALIA

Session title: "*Health promotion – an application of health economics to evaluate workplace health promotion programs*" (1 hour), 5 June

2013 Centre for Health Economics (CHE) "Seminar Series" Monash University, Victoria AUSTRALIA

October Seminar "*Methodological quality: a determinant of profitability in workplace health"* (1 hour) 3 October

2014 Featured author panellist for the *American Journal Health Promotion* webinar. INTERNATIONAL

Session title: "*The Relationship between Return on Investment and Quality of Study Methodology in Workplace Health Promotion Programs*" (30 minutes) 24 June

2015 ISPOR Australia Chapter Encore Presentations: "Predicting Future Evidence Workshop" c/o Centre for Applied Health Economics, School of Medicine, Griffith University, Queensland, Australia; held at University of Technology, Sydney AUSTRALIA.

Presentation title: "*Construct validity of SF-6D health state utility values in an employed population*" (15 minutes) 21 April

2015 Centre of Research Excellence in Patient Safety; "Patient Reported Outcome Measures (PROMs): new horizons in health-related quality of life improvements" c/o School of Public Health and Preventive Medicine; Monash University, The Alfred Centre, Victoria AUSTRALIA.

Presentation title: "*SF-6D health utility in employee populations: a valid health economic measure in workplace health promotion*" (15 minutes) 25-26 June

***partnering*H@W seminar presentations (for partners and interested public)**

2011 "*The economic evaluation of H@W: a PhD overview*" (10 minutes)

2012 "*The Business Case for Workplace Health: How Good Is the Evidence*" (30 minutes)

2014 "*Measuring Quality of Life in the Tasmanian State Service: can it inform economic decisions?"* (30 minutes)

Other presentations

2013 Community talk for Lindisfarne School for Seniors, Hobart AUSTRALIA. "*Economics of health promotion in the workplace*" August 9th (45 minutes)

Awards received from the work described in this thesis

Ten of the Best Awards 2014, certificate

Awarded on 17th February, 2015

For outstanding contribution to the field of Population Health Research for the publication titled "The Relationship between Return on Investment and Quality of Study Methodology in Workplace Health Promotion Programs"

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Provided $2,000 USD to assist in the travel expenses to present in Berlin GERMANY at the 21st Annual Conference of the International Society for Quality of life Research *"Quality of Life: Advancing Measurement Science and Transforming Healthcare*" 15-18 October, 2014

List of abbreviations and key terms

Abbreviation	Full term
95% CI	95 per cent confidence interval
ABS	Australian Bureau of Statistics
Algorithm	(or formula) The rule for converting answers to a questionnaire into a number. It is constructed by scaling a 'model'
Allocation efficiency	How effective a market or economy is in its dispersion of capital to the most productive opportunities
Allocative efficiency	A type of economic efficiency in which economy/producers produce only those types of goods and services that are more desirable in the society and also in high demand
ANZSCO	Australian and New Zealand Standard Classification of Occupations
Attribute	A characteristic or property which an instrument seeks to describe i.e. vitality, depression, mobility
BCR	Benefit cost ratio
BMI	Body Mass Index (kg/m^2) derived from self-reported height and weight measures
CBA	Cost benefit analysis, a form of economic evaluation where both the measurement of valuation for costs and benefits/effects/consequences are shown in monetary units
CEA	Cost-effectiveness analysis, a form of economic evaluation where the measurement of valuation for benefits/effects/consequences is natural units
CCA	Cost-consequence Analysis, a form of economic evaluation that displays an array of benefits alongside costs, measured in the most appropriate units
CUA	Cost-utility analysis, a form of economic evaluation where the measurement of valuation for benefits/effects/consequences is shown in healthy years (typically measured as quality-adjusted life-years)
Construct	An attribute which is constructed or conceptualised as part of a theoretical explanation. A construct created to explain observed relationships

Construct validity	The degree to which a measure measures what it purports to measure. Convergent validity occurs when the measure correlates with other measures. Discriminant validity is non-correlation with measures of different constructs (ie: MAU instruments with blood pressure)
DEDTA	Department of Economic Development, Tourism and the Arts
DHHS	Department of Health and Human Services
DIER	Department of Infrastructure, Energy and Resources
DoE	Department of Education
DoJ	Department of Justice
DPaC	Department of Premier and Cabinet
DPEM	Department of Police and Emergency Management
DPIPWE	Department of Primary Industries, Parks, Water and Environment
DTaF	Department of Treasury and Finance
Employment category	Employment defined as permanent or fixed term or casual
Employment condition	Employment defined as full-time or part-time
EQ-5D	Originally EuroQol (visual analogue scale (VAS) and time trade-off (TTO) versions), origin: Europe/UK
ERI	Effort-reward imbalance; a measure of job stress using a 17-item instrument with a two-part response: 6 items for effort and 11 items for reward. An effort/reward ratio over 1 indicates high job stress (high effort/reward imbalance)
H@W	Healthy@Work, the name of a workplace health intervention carried out over four years and aimed at improving the health of employees in the Tasmanian State Service
Healthy worker effect	An epidemiological term referring to selection bias in worker health outcomes compared to normative populations. Workers are more likely to be healthier and less susceptible to morbidity and premature mortality due to the very nature of being well enough to work compared to the general population that includes people unable to work due to health problems
HERO	Health Enhancement Research Organization, an American national non-profit organisation identifying and sharing best practices in employee health management through research, education, policy, strategy, leadership and infrastructure
HILDA	Household Income and Labour Dynamics of Australia survey; a clustered stratified panel survey of persons residing in private

	dwellings in Australia. Data collection commenced in 2001. The data set is maintained by the Faculty of Business and Economics, The University of Melbourne, Victoria Australia
HRQOL	Health-related quality of life; a multi-item measurement of the domains of health. Instruments can be generic, disease or population specific
HWA	WHO's global Healthy Work Approach, an initiative based on principles of health promotion, occupational health and safety, human resource management and sustainable development to strengthen stakeholders partnerships
iHEA	International Health Economics Association
Instrument	A questionnaire, scale or survey with an associated method for attaching a numerical value to the answers
K10	Kessler 10 Psychological Distress Scale; ten non-specific psychological distress questions that sum to give a total score between 10 (low) and 50 (high) psychological distress
MD23	Ministerial Direction 23 – Workplace Health and Wellbeing. A policy guideline drafted by the H@W central coordinators and passed in parliament on 7 June 2010.
MAUI	Multi-attribute utility instrument is a preference-based instrument to assess health status amenable to economic evaluations
Model	A conceptual or mathematical framework which defines how values will be combined (for example, simple or weighted averaging of the level of the item responses)
NICE	National Institute for Health and Care Excellence
NPAPH	National Partnership Agreement on Preventive Health, an Australian Government commitment of funds to assist national health promotion, prevention and care co-ordination bodies tackle the rising prevalence of lifestyle-related chronic disease
Occupational type	Employment types, categorised as blue collar, white collar, service, professional and manager as per ANZSCO classification
OECD	Organization for Economic Cooperation and Development, an international economic organisation of 34 countries to stimulate economic progress and world trade.

PAHSMA	Port Arthur Historic Site Management Authority
*p*H@W	*partnering*Healthy@Work; a collaborating team of researchers (from Menzies Institute for Medical Research and other schools within the University of Tasmania) and policy makers within TSS. This partnership had the specific task over five years (2009-2014) to evaluate both health and economic benefits of H@W alongside the project life.
PT	Public Trustee
QALY	Quality Adjusted Life Year, a single index measurement that combines length of life (life expectancy) adjusting for quality of life, commonly used in cost-utility analysis and seen as a gold standard measure in evidence-based decision making guidelines
RCT	Randomised Controlled Trial
Reliability	A measure of consistency. It is the proportion of the total variability in scores which is accounted for by the differences in the average values across observations. It applies to the interval consistency of the items of an instrument and to the test re-test consistency of the instrument over time.
ROI	Return on investment. An outcome from cost-benefit analysis that is expressed as a ratio formula, represented as (cost-benefit)/cost
SD	Standard Deviation
SE	Standard Error
SF-6D	Short form 6D (SF-6D (12) and SF-6D (36)) bracketed numbers represent the form from where the SF-6D is derived, origin: UK/USA. Preference-based measure of health status, known as a multi-attribute utility instrument (MAUI)
SF-12	Short form 12 (version 1 and version 2), origin: USA. A health-related quality of life measure of health status
SF-36	Short form 36. An original version of health-related quality of life measure of health status
Sensitivity	The extent to which the instrument content allows the detection of changes in a health state
SME	Small to medium enterprise
SNAPS	Smoking, Nutrition, Alcohol, Physical activity and Stress; workplace health intervention categories

TAFE	Tasmanian Skills Institute
TAO	Tasmanian Audit Office
TAS	Tasmania, the island State of Australia
TFS	Tasmania Fire Service
TSS	Tasmanian State Service, the Tasmanian Government comprising of the public sector state service workforce delivering public service to the State
UK	United Kingdom of Great Britain
USA	United States of America
Validity	Measurement of what is intended
WHO	World Health Organization
WHO-WPRO	World Health Organization – Western Pacific Regional Office
WHP	Workplace health promotion, a strategy, intervention or initiative aimed at improving the health and wellbeing of people at work
WTP	Willingness to Pay

1 Chapter one: Workplace health promotion: history, complexity, the role of health economics and introducing Healthy@Work

1.1 Introduction

This thesis investigated the application of health economics in workplace health promotion. It considered established guidelines and business needs to inform an economic evaluation of an organisational workplace health promotion project implemented in the Tasmanian Government, Australia; Healthy@Work (2009-2012). This introductory chapter described the history and economics of workplace health promotion, its complexity due to the multi-determinants of workers' health, its evolution across the decades, and the role of health economics in program evaluation. It also introduces the workplace health promotion project, Healthy@Work, and describes relevant information that was necessary for conducting its economic evaluation.

Throughout history optimising health and minimising threats to health have been a fundamental human endeavour. Today there is an increasing focus on preventive health (actions to reduce or eliminate disease) and health promotion "the process of enabling people to increase control over, and to improve their health" p1.[1] A major influence for this focus is the increased burden of disease due to preventable chronic conditions, and that in addition to an aging population and escalating health care costs, the public health system is struggling.[2] Explanatory models of health promotion are based on our understanding of the determinants of health, those primary conditions for health, such as education, housing, and employment. The analytical approach in health promotion incorporates legacies from the eras of public health (health protection, behavioural change), the 'new public health' (change facilitation, multi-sectorial partnerships)[3] and its latest extension, ecological public health (interdependence of sustainability, equity).[4,5] Subsequently, health promotion within an ecological framework recognises the influences of educational, economic, social, cultural, environmental, spiritual and political actions on individuals and communities and is committed to a multi-sectorial and collaborative strategy that will empower people and populations.[6]

Key elements of health promotion were formalised by the 1986 Ottawa Charter: 1) create supportive environments, 2) build healthy public policy, 3) strengthen community action, 4) improve personal skills and 5) re-orient health services.[1] These led to an organised public health 'settings approach' to strengthen structures and processes that act effectively on the determinants of health in all sectors, including workplaces.[7,8] By 2008 the World Health Organization's (WHO) Commission on the Social Determinants of Health[9] presented a clear message that investment within settings was necessary to improve the health and health equity of all. The challenge is how to evaluate health gains in sectors that traditionally measure success in terms of economic activity.[10]

1.2 Workplace health promotion

Workplace health promotion (WHP) has been defined in most recent years as “the combined efforts of employers, employees and society to improve the health and wellbeing of people at work” p 2.[11] This definition takes on a societal context, acknowledging that WHP relies on the involvement of all stakeholders, including government, insurers and trade unions. Implicitly it represents the multiple groups within society that can potentially experience gains through WHP. The fundamental principle underlying WHP is that through development of planned strategies to address identified employee health and wellbeing needs (these may include diseases, hazards, behavioural/environmental risks within the ecological framework), the health and wellbeing of employees will improve.

1.2.1 History of WHP, the link to economies and the business case

Traditionally WHP strategies had an ‘individualistic’ educational focus,[12] and predominantly targeted an individual employee’s modifiable lifestyle risks for chronic disease such as smoking, nutrition, alcohol consumption, physical activity, and stress.[13]

The prominence of workplaces as a public health ‘setting’ within the global health promotion movement was elevated in 1997 by the 4th International Health Promotion Conference in Jakarta, the Jakarta Statement[14] and the Jakarta Declaration.[15] Together they identified that workplaces had the ability to reach large populations of workers, their families, communities and societies as a whole, and that a healthy workforce was vital for sustainable social and economic development (Figure 1.1).

Work, Health and Development

Healthy workers

↓

Productive workers

↓

Successful businesses

↓

Healthy economy

↓

Sustainable development

Figure 1.1 Concept of healthy workplaces, linking healthy workers to sustainable development; WHO-WPRO (1999) Regional guidelines for the development of healthy workplaces[16]

In addition, a new initiative called the WHO global Healthy Work Approach (HWA) was established to serve as a catalyst to strengthen stakeholder partnerships and corporate sector investment. It was based on principles of health promotion, occupational health and safety, human resource management and sustainable development.[17] It acknowledged the economic value in optimising human resources through health promotion and aimed to inspire organisations to participate in WHP. For business, this value proposition holds true today and is reflected in current main drivers for the WHP business case: “Corporate values which recognize the social and economic relevance of a participatory workplace culture” p55. [18] Recognition of economic advantage and business success ensured WHP was seen as mutually beneficial for both employees and the organisations adopting it. Although the HWA initiative helped motivate the business case for WHP, fundamentally the ideology originated from a social responsibility to improve employee welfare and conditions,[19] not an organisation’s bottom line. However in the mid-1980s and preceding the HWA initiative, companies in the United States indeed recognised preventive health care at the workplace as a fiscally responsible approach to cost containment, especially for health-care related costs. This helped prioritise the development of criteria to justify a workplace health program,[20] which has become known as the business case for WHP.

Definition of a business case

A ‘business case’ provides information for business justification. It represents a financial evaluation to assist in company efficiencies and objectives. Ultimately it demonstrates the business need for a given action by providing reasoning to initiate, continue or cease a project. There are three important components of a business case;

1. expected business benefits,
2. expected costs of the project,
3. expected risks.

Consideration should also be given to the option of doing nothing (the inclusion of costs and risks of inactivity). Deciding if a project is worthwhile in order to allocate company funds requires putting a price on these components. Inherently what the costs benefits and risks are ‘expected’ to be requires decisions around potential performance.

Source: Messner (2013) making the Compelling Business Case[21]

Evaluating the business case of WHP is complex as it involves measuring the potential performance on outcomes of health. Complex because health by definition is a ‘state of being’ that requires action and is affected by behaviour which can be difficult to change.

Also, health is affected by processes outside an individual employee's control. Ill-health can be created within the organisation itself. The evolution of WHP is nuanced by our understanding around the multi-determinants of workers' health.

1.2.2 The evolution of WHP through the multi-determinants of workers' health

Global recognition for the multi-determinants of workers' health identified a new set of leading indicators that helped target and reorientate WHP efforts.[7] Factors affecting worker health and wellbeing were not only related to individual lifestyle and living conditions (the early single target 'individualistic' WHP focus) they were now seen to also include a number of workplace determinants (work styles and practices, work groups, organisation and culture, environment and working conditions).[16,22] Greater understanding of the role workplaces play in the health of workers illustrated that the workplace has the potential to heal or harm, and that health was not the sole responsibility of the worker.[23] For example, enabling factors in workplace culture (sense of community, positive culture, shared vision) were identified as relevant for improving worker health practices.[24] Acknowledgement of the multi-determinants of worker health ultimately shaped WHP in the 1990s to what is now seen as the latest generation in the evolution of WHP strategies.[8,25] Ideally, WHP should be:

- Multi/interdisciplinary and integrative in approach and including environmental, social and organisational measures,
- Strategic in managing health, with strategies incorporating all activities, policies, and decisions,
- Targeting the health of employees, their families, and their communities, and
- Linked to market success through consumer purchasing decisions.

Subsequent research has demonstrated that multiple interacting work-related factors both directly and indirectly impact workers' health.[26,27] Moreover, the processes and impacts on workers through this broader concept of WHP have been inextricably linked to both employee health and company performance. These have been showcased in a conceptual model.[28] Within the model (Figure 1.2) are both the individual health and organisational outcomes of specific interest for the work within this thesis. The complexities inherent in the multi-determinants of health remain one of the biggest challenges in developing methodology, economic models and resources to assist the business case in WHP.

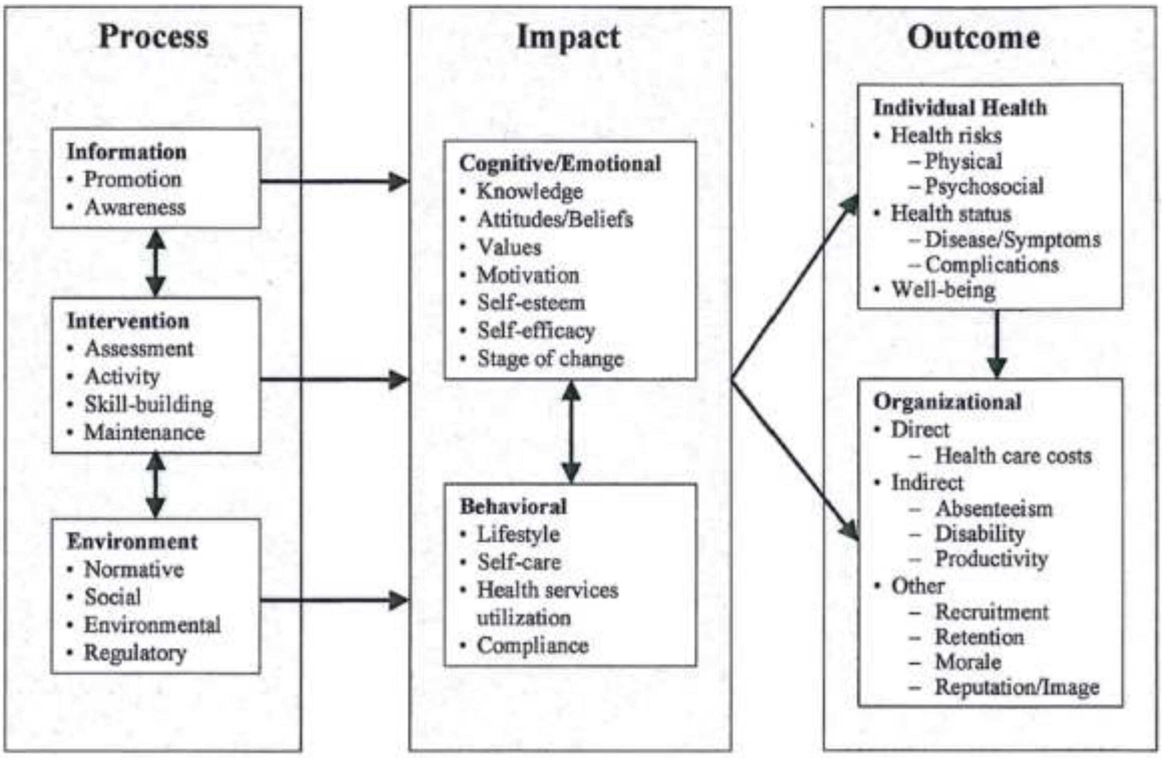

Figure 1.2 Conceptual model of WHP, with permission from the authors and the American Journal of Health Promotion[28]

1.2.3 WHP is a complex concept with global participation

Not only is WHP complex, the settings in which WHP is implemented are vastly variable. Today, businesses offering a WHP initiative are multifarious, and spread worldwide throughout many jurisdictions and political contexts. Without confirmatory academic publications to this effect, a recent global workplace health promotion study within a grey literature report[29] charted 1,041 businesses active in delivering WHP by region. Figure 1.3 shows the spread.

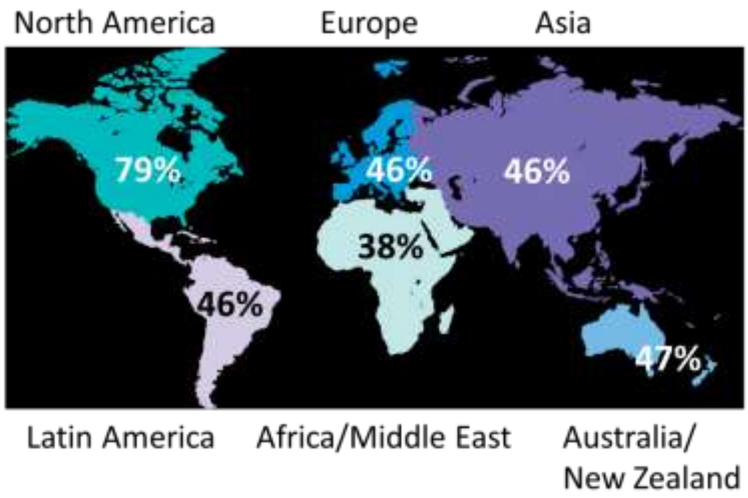

Figure 1.3

Indication by region of where companies are offering WHP.

Source: "Working Well: A Global Survey of Health Promotion, Workplace Wellness and Productivity Strategies" Buck Consultants

1.3 The role of health economics in WHP evaluation

Health economics is a discipline considered by most to have been formalised in an article published in 1963 in the American Economic Review. Written by Kenneth Arrow it was titled "Uncertainty and the welfare economics of medical care,"[30] although earlier contributions to health economics have been noted (one dating back to the 17th Century)[31,32] and the earliest definition was published in 1958 by Selma Mushkin.[33] The history of health economics is not pivotal to this dissertation, except to state its relative youth and consequential developing methodologies in comparison to other scientific disciplines.

1.3.1 Definition of health economics

Health economics is a subdivision of economics, and is

> *"the study of how scarce resources are allocated among alternative uses for the care of sickness and the promotion, maintenance and improvement of health, including the study of how healthcare and health-related services, their costs and benefits, and health itself are distributed among individuals and groups in society." World Bank Health Economics Glossary* [34]

Thus, health economics is a science of choice in an environment of scarcity. It is used to inform decision makers on how best to allocate their resources, most often with the aim to measure and optimise health benefits for a population.[35] The first ever recorded health economic evaluation (well before the discipline formally emerged) quantified costs and benefits of measures to reduce the effects of the plague in 17th Century England (Appendix 1A). Important categorisations in economic thought are microeconomics and macroeconomics. Microeconomics refers to decisions of individual consumers and firms and is distinct from the broader 'macro' scale economic aggregates such as gross domestic product.[36]

The focus for this thesis is on the application of health economic evaluations to inform the business case for WHP. This thesis draws from microeconomic theory of health economics. This is an important distinction as it relates to scope and one that determines what tools and methods of health economics are available for use, for there are numerous elements within the discipline itself (Figure 1.4). This thesis is delineated by the multi-determinants of workers' health (Figure 1.4, Box A), how health is defined and valued by decision makers implementing WHP (Figure 1.4, Box B) and the microeconomic application of economic evaluations (Figure 1.4, Box E). It should be noted that this thesis offers no evaluative focus on interactions between different sectors of the economy to address the global public health's 'settings approach' – the social reforms where WHP has gained its universal adoption (Figure 1.4, Box G).

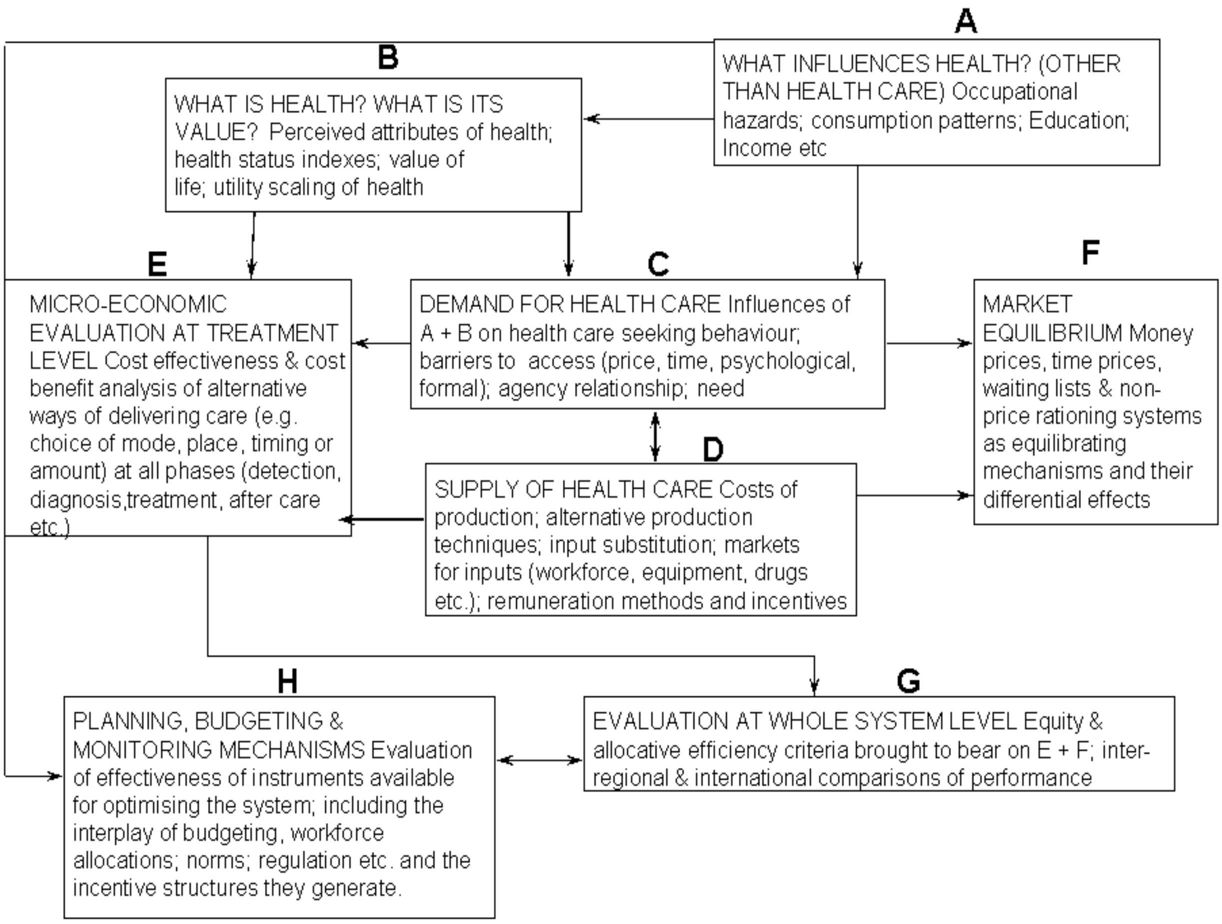

Figure 1.4 The plumbing diagram (Williams, 1987): a schematic presentation of the main health economics elements.[37] **Available and reproduced from the public domain**

1.3.2 Economic evaluations

Considering the business case inputs of cost, benefit and risk to evaluate feasibility of a project from the company perspective, the application of health economics to conduct health economic evaluations of WHP appears to be a good fit.

An economic evaluation is "*the comparative analysis of alternative courses of action in terms of both their costs and consequences*" p9 [35] They are carried out so that resources (costs) are allocated efficiently, considering the consequences (benefits or adverse effects) that arise. The decision makers (i.e. government or business) then use the information provided in the evaluation to decide whether to fund an action (intervention, program). When faced with resource scarcity, decision makers usually have a limited or fixed budget and many possible alternative actions where resources could be utilised. Therefore it is an inherent task for economic evaluations to deliver a comparative analysis to provide information on actions that may or may not be beneficial enough in respect to the best alternative use of funds.[35] Ultimately an economic evaluation should answer the question: "Is the action good value for money?"

1.3.3 Types of analysis in economic evaluations

The type of analysis needed to answer this question depends on how the benefits are expressed. There are several types relevant to this work. When benefits are expressed in terms of a single unit of effect, such as function, risk severity or other units (i.e. blood pressure or number of days absent) the analysis is known as a **cost-effectiveness analysis** (**CEA**). If this effect is measured by healthy years (i.e. using a preference-based health measure such as health utility) the analysis is referred to as a **cost-utility analysis** (**CUA**). In a **cost-benefit analysis** (**CBA**) all consequences, (i.e. benefits due to improved health, future healthcare costs avoided or increased productive output due to improved health status, or adverse consequences like side effects) are translated into a monetary value. All three analytical types can offer a value for money answer as they value effectiveness measure(s) relative to its costs.[38,39] In contrast, a form of evaluation that does not provide an estimate of value for money, but that is still of interest is the **cost-consequence analysis** (**CCA**). This type is appropriate when there are multiple benefit measures making value for money difficult to precisely quantify. A CCA presents data on all costs and benefits, measured in the most appropriate units. For the decision maker this form of economic evaluation displays an array of benefits alongside costs so they can decide on relative importance.[40] From this the analyst can value specific outcomes of interest as needed.[35] In 2000 a review of abstracts within the UK NHS Economic Evaluation Database (NHS EED), evaluations were most likely CEA (85%) rather than CUA (9.3%) or CBA (1.4%).[41] There was no analytical breakdown for CCA, although a more recent 2009 review of public health interventions found 78% of economic evaluations conducted either a cost-effectiveness or cost-consequence analysis.[42] This indicates the common types of economic evaluations used in public health and reflects the National Institute for Health and Care Excellence (NICE) in the UK's support for conducting CCA's when it is not appropriate to conduct CEA or CUAs.[43] In both reviews, studies conducted in workplace health promotion were not specified. A summary of analysis types, what costs and benefits are assessed, characteristics, strengths and challenges when applied to WHP are presented in Appendix 1B.

1.3.4 Components of an economic evaluation

There are three components of an economic evaluation[36]

1. Framing the evaluation.
2. Identifying, measuring, valuing costs.
3. Identifying, measuring, valuing consequences (outcomes, benefits, adverse events).

Framing involves a clear statement of whose costs are considered (the perspective), the purpose for conducting the evaluation and the time frame (as costs and benefits change). When identifying, measuring and valuing costs and benefits a number of influences need to be considered. These are displayed in Figure 1.5.

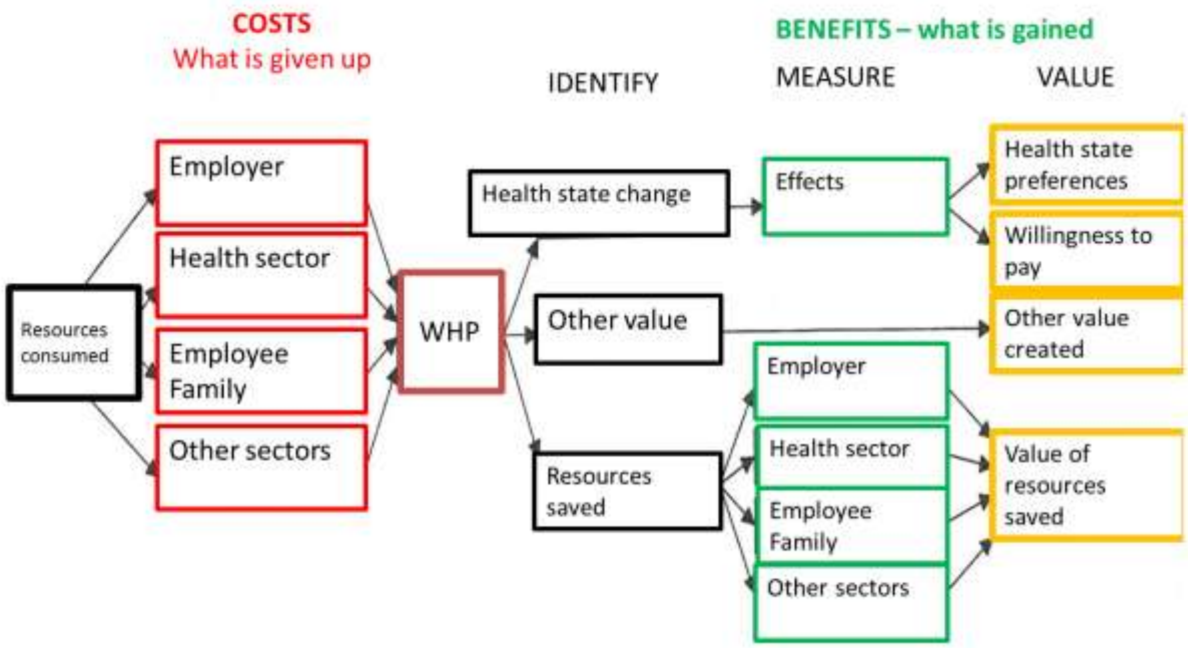

Figure 1.5 Components of an economic evaluation as applied to a WHP action: identify, measure and value costs and benefits. Adapted from Drummond et al. (2005)[35]

In summary, the application of health economics theory advises that financial analysis of WHP should fundamentally analyse health and its impacts on health benefits, first by defining health and placing value on it, and second by conducting an evaluation that responds to the existence of competing priorities, limited resources, and unlimited demands. When economic evaluations fail to follow these principles the information provided may contribute to inefficient policy and practice, and could be considered of low methodological quality.[44]

1.3.5 Quality of economic evaluations

There have been longstanding discussions concerning the quality of economic evaluations in WHP.[45-48] The earliest dates back to a 1988 review. It concluded “the claims of profitability are based on analyses seriously flawed, in terms of assumptions, data, or methodology” p106. [45] The trepidation surrounding economic evaluation results is not specific to WHP, and as health economic theories started entering the medical research literature in the 1990s, guidelines, recommendations and checklists were produced to strengthen the methodology of the discipline as a whole.[44,49-52] Critical assessment of economic evaluations are paramount to minimise risk of bias[53] and checklists have been developed that separate the various elements of methodology within an economic evaluation so that closer scrutiny can take place.[35,54-60] Although to date only one checklist has been formally validated,[58] two have received more scrutiny than most and are recommended by economic guidelines.[52] They are: British Medical Journal Checklist for authors and peer reviewers of economic submissions;[54] and Consensus on Health Economic Criteria (CHEC) list for assessment of methodological quality of economic evaluations.[55] Most recently a consolidated reporting standard has been endorsed and co-published in the attempt to meet consensus among academia, clinicians, industry, government and editorial boards, and to guide authors in reporting economic methodology.[61] It is known as the Consolidated Health Economic Evaluation Reporting Standards (CHEERS).

It is important to highlight that no checklist specific to workplace health promotion exists. In addition, the WHO European Working Group on Health Promotion Evaluation in their examination of evaluation methods noted that the criteria to judge quality of evidence are not altogether optimal for decision making in health promotion.[62] This sentiment can be extended to workplace health promotion, and as such, currently available economic quality checklists may not produce the most precise information appraisal for WHP initiatives.

Nonetheless all available checklists address similar economic elements and seek to improve the credibility of the research endeavour, that is, to determine if the study is appropriate and results are valid, transferable and generalisable to other settings. Checklist items include: perspective, type of comparator, economic form, costs and benefits (identified, measured, valued), incremental analysis, dealing with uncertainty, discount rate, time horizon, and funding source.

In the Campbell and Cochrane Economics Methods Group handbook it states: “there has been relatively little empirical research to investigate the impact upon the results of a critical review of health economics studies, of decisions to include economics studies that meet some but not all standards of methodological quality” Section 15.5.2.[53] Chapter 2 of this thesis is one such example. It contains research that investigates the relationship of methodological quality on financial outcomes in WHP.

1.3.6 Employer costs and benefits in workplace health promotion

In order to consider health economic methodology in WHP, the component costs and benefits of a health program in the workplace must be identified. These can be many and varied and there is no set standard. Identified costs and benefits in WHP are specific to the type of WHP, whose resources are being used, and what processes, impacts and outcomes are of importance to the decision maker. A non-exhaustive list represented across the literature is provided below.

Costs: program start up and operation, educational materials, personnel, facilities, infrastructure, overhead, supplies to run program (i.e. posters, newsletters), IT support, training, administration, marketing, lost productivity, accident and injury, overtime and temporary staffing, overall cost to society: due to increased pain,suffering, and illness.

Benefits: improved company brand, higher productivity (reduced absence/presenteeism), higher commitment, improved employee resilience, reduced claims (medical, legal, worker compensation, pharmaceutical, therapy), improved staff turnover/retention/attrition, decreased replacement training, better employee job satisfaction/motivation, improved company profile/competitiveness, potentially higher profitability, minimal customer dissatisfaction, improved service and quality, better working conditions, climate, culture, organisation and overall benefit to society: due to decreased pain and suffering, and increased quality of life.

An illustration of the economic benefits of WHP at a company level was adapted from the European Network for Workplace Health Promotion ‘Healthy Employees in Healthy Organisations’ Report (Figure 1.6):

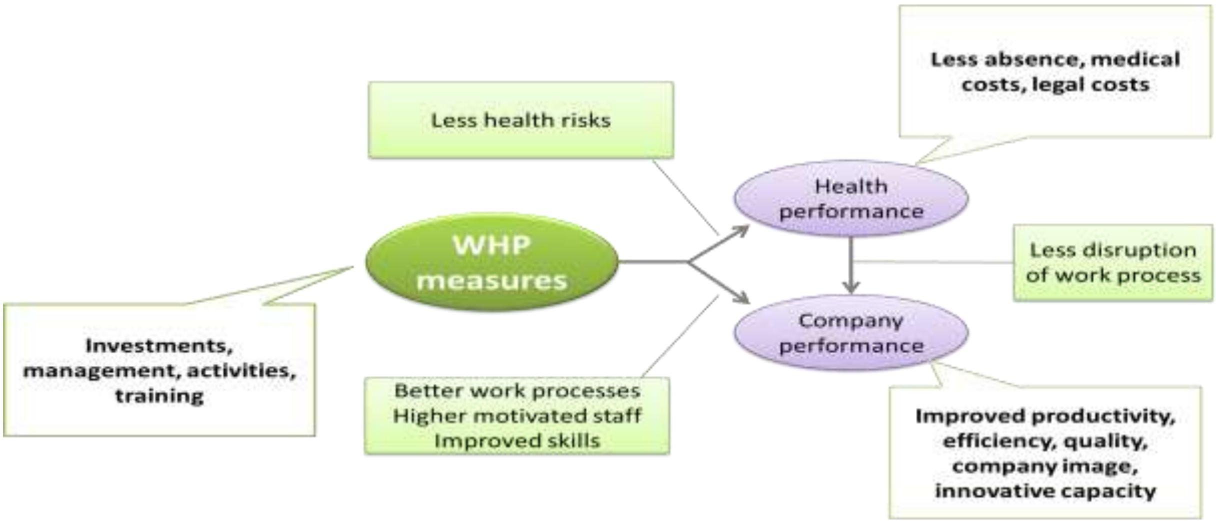

Figure 1.6 Economic benefits of WHP at the company level, adapted from Mossink (2002)[63] and de Greef (2004)[18]

Given such breadth of component costs and benefits in WHP assures not only a high level of complexity when conducting financial analysis,[28] but also the need for continual monitoring and reassessment of their appropriateness[64] and the fundamental importance of high quality economic reporting standards to overcome inherent difficulties in translation across settings.[61] Ultimately the decision to invest will lie with the decision maker.

In countries with national health coverage, such as Australia, companies need not invest in WHP to lower medical care costs. Although there is limited empirical investigation within this context on what categorises decision makers' intentions to invest in WHP, one study identified four main reasons;[65]

1. Moral responsibility - doing social 'good' not 'harm' to your employees,
2. Subjective norms - 'because others do it' and there's a perceived social pressure,
3. Volitional control – use of free will being in a position to do something, and
4. Attitude – there is value that is seen in the expected outcomes.

Component costs and benefits that make up the business case for WHP influence only one of these four; the *attitude* of decision makers. There are numerous other reasons to embark on providing WHP and although adoption and sustainability is part-assisted by robust economic evaluations, it should be contextually noted that WHP is more than just economics to many.

1.4 WHP in Australia

Workplace health promotion in Australia has followed overseas trends and the evolutionary phases of health promotion which has led to its current integrated organisational development approach.[7] In 2010-11 Australia was ranked 21st out of the 24 OECD countries for its prevention and public health spending (1.7% of total health expenditure, 0.16% of gross domestic product), equivalent to $85 per person that year.[10] In 2008 the Australian Government committed $932.7 million over nine years (2009-2018) in a National Partnership Agreement on Preventive Health (NPAPH). This was to assist national health promotion, prevention and care co-ordination bodies tackle the rising prevalence of lifestyle-related chronic disease. Primarily NPAPH was facilitated from a state and territory level, of which in Australia there are seven. 'Healthy Workplaces' was one of three funded settings under the NPAPH and WHP received its largest ever funding commitment of $294 million Australian dollars.[66,67]

1.5 WHP in Tasmania

Tasmania is the island state of Australia. Before the NPAPH incentive funding Tasmanian workplace health and wellbeing initiatives gained most prominence when the Tasmanian State Government via the Premier's Physical Activity Council outlined a model for WHP in a toolkit; 'Get Moving at Work: A resource kit for workplace health and wellbeing programs.'[68] It was based on existing national and international best practice. Other key State policy documents that set the direction for promoting health in the workplace were "Connecting care: Chronic Disease Action Framework for Tasmania 2009–2013,"[69] "Working in Health Promoting Ways: a Strategic Framework,"[70] the "Tasmanian Physical Activity Plan 2005-2010," its updated version "Tasmania's Plan for Physical Activity 2011-2021,"[71] and "Building the Foundations for Mental Health and Wellbeing: A Strategic Framework and Action Plan for Implementing Promotion, Prevention and Early Intervention (PPEI) Approaches in Tasmania, 2009."[72] Workplace health and safety legislation and regulation for businesses in the state are governed by WorkSafe Tasmania, a division of the Tasmanian Department of Justice.

1.6 Healthy@Work (H@W), a Tasmanian State Government WHP project

The ultimate aim of this thesis was to conduct an economic evaluation of H@W. H@W was a Tasmanian Government project, developed independently of the research-policy evaluation team (see 1.8 *partnering*Healthy@Work) and implemented across the Tasmanian State Service (TSS).

1.6.1 Study setting

The TSS is the public sector state service of Tasmania located within fourteen Agencies and Authorities (agencies) throughout the island state (68,401 square kilometres[73]). It delivers public service to the state's 510,600 inhabitants.[74] Employees within the TSS are diverse and include senior executives, front line workers, clerical workers, administrators, lawyers, teachers, police, health and emergency personnel, technicians, service providers, labourers, junior graduates and cadets. They are either full-time, part-time or casual in employment, hold permanent, fixed-term or casual contracts, and are within occupations that fall under the following departments: Department of Treasury and Finance (DTaF); Department of Health and Human Services (DHHS); Department of Police and Emergency Management (DPEM); Department of Education (DoE); Department of Economic Development, Tourism and the Arts (DEDTA); Department of Infrastructure, Energy and Resources (DIER); Department of Justice (DoJ); Department of Premier and Cabinet (DPaC); Department of Primary Industries, Parks, Water and Environment (DPIPWE); Tasmanian Audit Office (TAO); Tasmania Fire Service (TFS); Public Trustee (PT); Tasmanian Skills Institute (TAFE); and Port Arthur Historic Site Management Authority (PAHSMA).

Implementation of H@W was one way the TSS is responding to increasing uncertainty, including fiscal constraints, demographic change and an aging population. TSS employees number close to 30,000 and are pivotal to the success of the state for their provision of Government services, policies and programs to the whole community. However, the employees are aging and the future composition of the TSS is facing great challenge.

> *"In the next five to ten years, more than 50 per cent of the State Service workforce will be at the minimum retirement age. In excess of 15,000 people may exit the workforce"* p4 [75]

1.6.2 The Healthy@Work (H@W) Project

The 2008-2009 Tasmanian State budget included funding for H@W, a four-year workplace health and wellbeing project (2008-2012). The government's vision for this project was 'well developed and effective workplace health and wellbeing initiatives integrated within each Tasmanian Government Agency.' The H@W model was developed within the Public Sector Management Office, an office of the Tasmanian DPaC. To develop health promoting initiatives the H@W model required the organisation to:

1. Establish organisational commitment
   - Identify key champions
   - Ensure a commitment from management
   - Encourage staff commitment
2. Construct the program
   - Identify staff issues
   - Identify workplace environment and policy issues
   - Implement suitable initiatives based on the issues identified
3. Manage and evaluate
   - Implement specific initiatives
   - Evaluate the program and it's initiatives
   - Refine the program and it's initiatives

As outlined by the H@W Communications Strategy (Feb 2010-11), project principles were: Equity of access, Leadership, Targeting of key priorities, Organisation based strategies, Flexible model and Evidence of the impact. Key principles for implementing H@W programs are outlined in Table 1.1. The management team within the TSS developed these principles from evidence[13,16,76-78] and documented them in the H@W policy guidelines.[79]

Table 1.1 Key principles for H@W workplace health and wellbeing programs, developed from evidence

1. Is cost-effective and may not be expensive.
2. Acknowledges and supports Occupational Health and Safety.
3. Is managed within the workplace.
4. Includes an assessment of needs to identify health issues in the workplace.
5. Involves voluntary employee participation and attains high participation.
6. Includes training in health promotion/workplace health promotion principles and access to appropriate information and resources for staff responsible for coordinating the program.
7. Is sustainable and involves a long-term commitment.
8. Involves equitable access for staff irrespective of their current health status or role within the organisation.
9. Includes an evaluation process.
10. Recognises that an individual's health is determined by a set of interdependent factors.
11. Uses a mix of strategies that simultaneously identify or address individual, environmental and organisational issues.
12. Considers the workplace structures, cultures and policies.
13. Involves senior management and senior management owns the program.

14. Is integrated into the organisations' operations through program governance, administration and staffing.
15. Promotes programs and outcomes internally and externally.

From the onset, H@W embedded best practice by integrating within an existing process within the TSS known as People Directions, a comprehensive workforce management strategy targeting important issues such as leadership, capability development, planning, attraction and retention, and included projects such as "Who We Are" (identity attributes and attitude) and "Talking With Our People" (communications strategy).[75]

1.6.3 Healthy@Work (H@W) the intervention

$2.04 million Australian dollars were budgeted for H@W over the 4 year implementation period. For this, the TSS sought to establish a culture that values, supports and improves the health and wellbeing of employees. H@W was centrally coordinated by the Public Sector Management Office. This included developing and resourcing interventions across all agencies and incorporated: a coordinated education and communication strategy, mental health and wellbeing training, consultancy service, a project website, agency grants and subsidies.[80] Further details of the interventions can be found in Chapter 5. In brief, each Agency (n=14) within the TSS was required to develop a workplace health program plan for preventive strategies based on the H@W implementation cycle (Figure 1.7) and key principles (Table 1.1). Identification of employee needs and preferences were conducted in 2009 using an online employee assessment tool, including automated user-feedback for employees and Agency summary data generation for managers. This identified any number of key health risk factors for appropriate program targeting. Programs included activities and health-promoting interventions for smoking, nutrition, physical activity, breaking-up sedentary time, alcohol consumption and psycho-social health. Examples included stress management, pedometer challenges, influenza vaccination, sedentary break time, healthy catering (cafeteria or vending machines), Employee Assistance Programs (EAP), smoke free policies and other activities encouraging an organisational change approach to improve culture, policies and resources in relation to employee health and wellbeing.

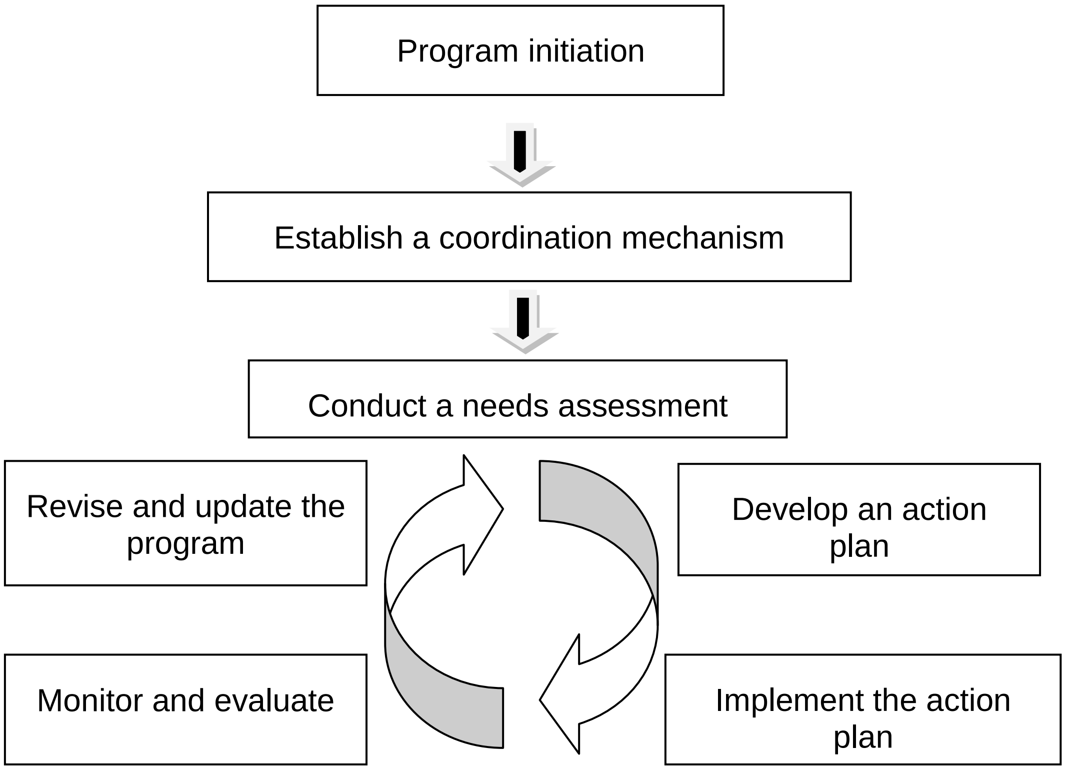

Figure 1.7 Healthy@Work implementation cycle

1.7 *partnering*Healthy@Work (*p*H@W) the evaluation of H@W

The year following commencement of H@W, a partnership was formed between policy makers within TSS and researchers at Menzies Institute for Medical Research as well as other schools within the University of Tasmania. This partnership known as *partnering*Healthy@Work (*p*H@W) had the specific task over five years (2009-2014) to evaluate both health and economic benefits of H@W alongside the project life. The partnership offered researchers a unique opportunity to prospectively investigate a population-wide dissemination of WHP in a real world setting with the aim to address the feasibility, effectiveness and sustainability of workplace health promotion. It also provided the TSS with evidence during the implementation years that could inform and assist individual agencies to tailor programs to meet changing needs. Ultimately *p*H@W afforded the *p*H@W team a collaborative milieu to bring evidence-based research to policy decisions, in relation to action, translation and sustainability efforts of H@W.

No opportunity for research input on the implementation phase of H@W had been available, indeed there was a short lag time to form and formalise the partnership. Thus the researcher contribution was solely within an evaluative scope. Subsequently, no H@W control population was established, and researchers attempted to address the complexity of these types of interventions when rolled out to entire populations and within designs contrary to gold standard research criteria. For instance, and in respect to this thesis, health economic guidelines recommend randomised controlled trial as the suggested experimental design due to a common economic focus on clinical medicine.[53,81]

From the onset, *p*H@W collaborated to provide evidence of effectiveness that had greatest utility for the TSS and that would assist the H@W project. *p*H@W investigators consisted of nine senior researchers, six senior policy makers and three PhD students. Works arising from the other students include theses titled "Promoting mental health in a large and diverse public sector workforce" (Lisa Jarman) that focussed on mental health and job stress, and "Healthy@Work? Lifestyle factors and workplace health promotion" (Michelle Kilpatrick) focussed on health-related behaviours and overweight and obesity, and employee engagement.

1.7.1 Funding

*p*H@W was funded by a research grant from the National Health and Medical Research Council Partnership Projects (Australia), grant no. 544954. Study results and publications arising out of the partnership were not contingent on funder approval. The TSS senior policy makers within *p*H@W were considered partners in the research and as such they helped set the research priorities and contribute to what was measured. Partner approval was sought for works within Chapters 2, 3, 4, and 5 of this thesis and their role as co-author in works within Chapters 3 and 5 has been noted within the Statement of Co-authorship.

1.7.2 Public sector internship

Due to the unique nature of the research-policy collaboration within the *p*H@W investigative team, a three month (100 hour) practical student placement for each of the three PhD students involved in the project was agreed upon. It aimed to provide a working model of a public service orientated research-policy alliance and demonstrate a positive example of the value of partnership in translational research. As one of the three students my internship was to offer additional research resources to the DHHS, Healthy Workers Initiative team, to assist in the development of the Healthy Workplace Resource Toolkit. Outcomes from my internship were presented in Chapter 3.

1.7.3 Ethics

*p*H@W was conducted in accordance with relevant privacy legislation and with approval from the Tasmanian Health and Medical Human Research Ethics Committee; No. H0010501. Ethics approval for the public sector internship was granted by the Social Science Human Research Ethics Committee (Tasmania) Network; No. H0012482.

1.7.4 *p*H@W design and data sources

1.7.4.1 Design

Selected variables from a centralised TSS administrative database of employees was provided to researchers by policy partners. This database was password protected and stored on a secure digital medium that only the *p*H@W statistician accessed. After extraction, identified information was removed from electronic access. The database allowed for linking of *p*H@W survey responses (see 1.7.4.3 Data sources) to employee specifics (i.e. salary, tenure, employment category), for cross-referencing self-reported responses such as age. It also allowed for unique IDs to be assigned to each employee for matching purposes (see 1.7.4.2 Sampling frame). A unique ID was defined as a unique employee number within a single agency and not necessarily an individual person. There were 46,411 database records and 27,659 unique IDs in the *p*H@W sampling frame.

1.7.4.2 Sampling frame

46,411 records from a centralised TSS administrative database

Exclusions:

5 records without agency information (coded "None")

144 records from one agency used in initial survey pilot (not re-sampled)

8613 records without matching name and address agency data.

8850 records with zero full time equivalent hours employed (i.e. recorded as unpaid)

In total, 28,799 records were available for sampling (27,659 unique IDs).

Acknowledgement: Thanks to Petr Otahal, Statistician, *p*H@W

Survey participants were selected by stratified random sampling of unique IDs. Stratification was by agency and four types of employment categories and tenure (full-time, part-time, fixed term/casual and permanent). A flow chart of the sampling procedure is provided in Figure 1.8. This sampling procedure allowed for weighting in analyses.

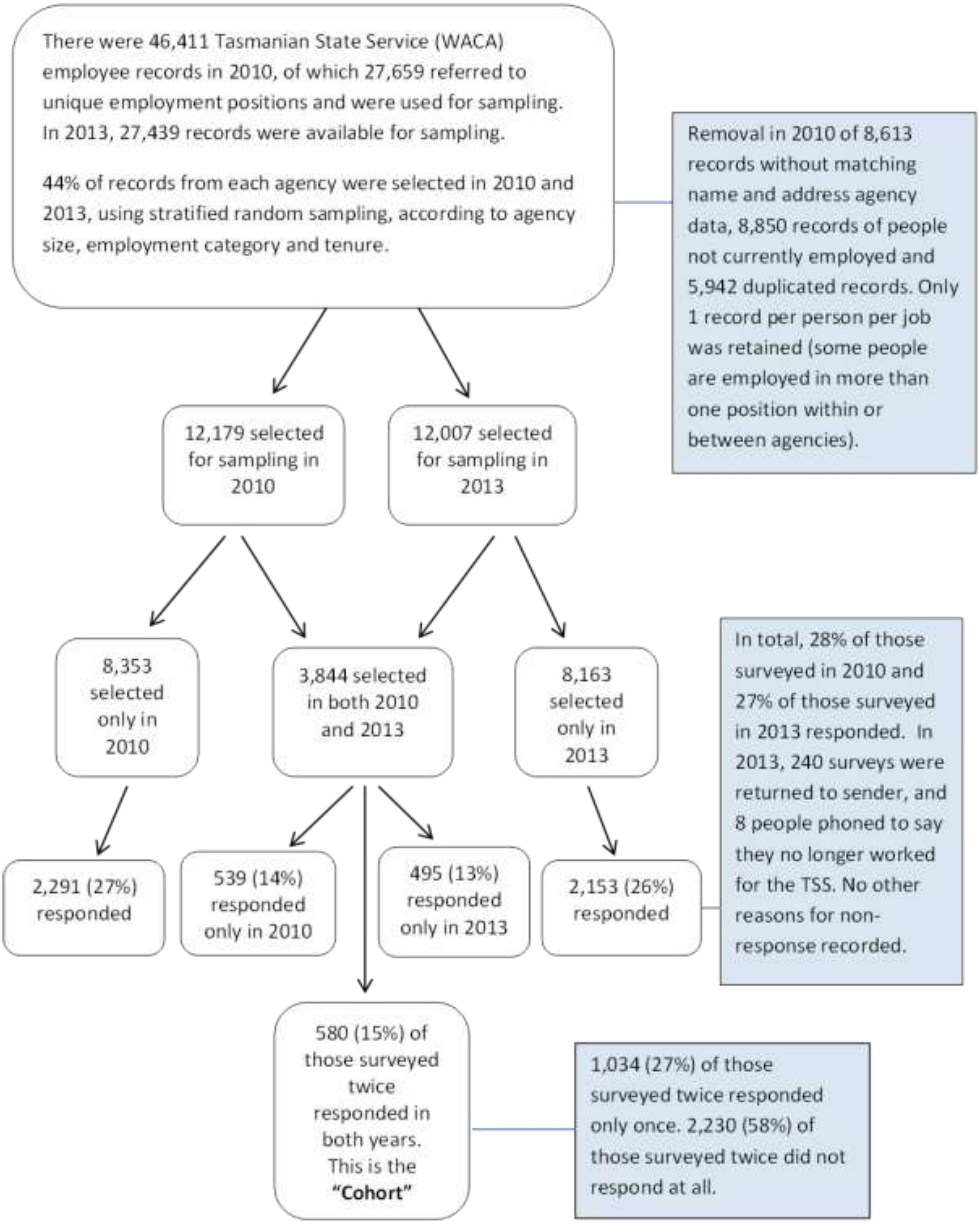

Figure 1.8 Flowchart of *p*H@W sampling procedure. Acknowledgement: Thanks to Kate Chappell, Data Manager, *p*H@W

1.7.4.3 Data sources

The sources of information on the TSS employee population that were primarily used in this thesis were:

- *p*H@W survey 2010 (Appendix 1C)
- *p*H@W survey 2013 (Appendix 1D)

These surveys were developed by collaboration within *p*H@W to include measures relevant to both researchers and decision makers. Validated measures were used where available. Surveys were administered to employees at two time points (2010 and 2013) using a repeated cross-sectional design. Refer to Chapter 4 and 5.

The sources of information used to investigate H@W at the organisational level are:

- TSS health and wellbeing agency audit 2010
- TSS health and wellbeing agency audit 2011
- TSS health and wellbeing agency audit 2012
- TSS agency health and wellbeing plans

Audits were completed yearly by all agencies in the organisation by a senior member of staff, usually the H@W co-ordinators or heads of agency. Audits were developed by the Government and were conducted as part of the TSS internal policy evaluation of the H@W project. They provided a report on the status of each agency health and wellbeing program in accordance with policy guidelines. These guidelines were outlined in *Ministerial Direction 23 – Workplace Health and Wellbeing* that were drafted by the H@W central coordinators and passed in parliament on 7 June 2010.[79] Both quantitative and qualitative data in the audit were used in this thesis to measure organisational capacity. Refer to Chapter 5.

1.7.5 Additional data source: Household Income and Labour Dynamics of Australia Survey (HILDA)

Outside the H@W project and *p*H@W partnership, a final data source was used herein. The HILDA survey provided Australian normative data. The data set is maintained by the Faculty of Business and Economics, The University of Melbourne, Victoria Australia and an Individual Deed of Licence for HILDA general release 11 data was executed on 26 August 2013.

HILDA is a clustered stratified panel survey (commencing 2001) of persons residing in private dwellings in Australia. The analysis in Chapter 4 used SF-36 (version 1) data from employed individuals within Wave 11 obtained from a self-completion questionnaire. SF-36 is used to derive a preference-based measure of health status.[82] Further details regarding

HILDA are available[83,84] including the criterion validity of SF-36 in HILDA for use in Australian research.[85]

1.8 Structure of this thesis

The research presented within this thesis consists of four separate studies as planned publications. The context of the work was to inform the *p*H@W partners of the Tasmanian Government on whether H@W provided value for money. To do this my overarching aim was **to investigate the application of health economics to evaluate workplace health promotion.**

Chapter 2 is a systematic review that investigated the methodological quality of economic evaluations to see what the expected return on investment was likely to be and determine what significant correlates of this economic outcome were.

Chapter 3 is the outcome from my public sector internship, a resource development project. This chapter describes the development of a Workplace Health Savings Calculator that has subsequently become publicly available as an Australian federal government WHP business case tool.

Chapter 4 is a construct validation study of a health utility measure (SF-6D) to meet the economic evaluative need for improved health measures, and

Chapter 5 is the economic evaluation of Healthy@Work.

Chapter 6 provides an overarching discussion of the work presented, including the issues, limitations and recommendations related to the application of health economics in the evaluation of workplace health promotion.

1.9 References

1. World Health Organization. Ottawa Charter for Health Promotion. Available at http://www.who.int/healthpromotion/conferences/previous/ottawa/en/ Accessed Sept 2012. 1986.
2. Australian Government Department of Health. Australia: the healthiest country by 2020 - National Preventative Health Strategy - Overview, National Preventive Health Taskforce report 2009 Available at http://www.health.gov.au/internet/preventativehealth/publishing.nsf/Content/national-preventative-health-strategy-1lp Accessed on May 2015. 2009.
3. Awofeso N. What's New About the "New Public Health"? *Am. J. Public Health.* 2004;94(5):705-709.
4. McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ. Behav.* 1988;15(4):351-377.
5. Sallis JF, Owen N, Fisher EB. Ecological models of health behavior. *Health behavior and health education: Theory, research, and practice.* 2008;4:465-486.
6. World Health Organization. Milestones in Health Promotion; Statements from Global Conferences. WHO/NMH/CHP/09.01 Available at http://www.who.int/healthpromotion/Milestones_Health_Promotion_05022010.pdf?ua=1 Accesed on May 2015. 2009.
7. Chu C, Breucker G, Harris N, et al. Health-promoting workplaces—international settings development. *Health Promot Int.* 2000;15(2):155.
8. Chu C, Driscoll T, Dwyer S. The health-promoting workplace: an integrative perspective. *Aust. N. Z. J. Public Health.* 1997;21(4 Spec No):377-385.
9. World Health Organization. *Commission on Social Determinants of Health - final report. Closing the gap in a generation: Health equity through action on the social determinants of health. Available at http://www.who.int/social_determinants/thecommission/finalreport/en/* Geneva 2008.
10. Shiell AH, P. Jan, S.,. *Feature Essay: The Economic Value of Prevention in State of Preventive Health 2013. Available at http://anpha.gov.au/internet/anpha/publishing.nsf/Content/state-of-prev-health-2013 Accessed November 2013.* 2013.
11. European Network for Workplace Health Promotion. Luxembourg Declaration on Workplace Health Promotion in the European Union, adopted on November 27-28, 1997 and updated in June 2005 and January 2007. Available at http://www.enwhp.org/fileadmin/rs-dokumente/dateien/Luxembourg_Declaration.pdf Accessed on 16 April, 2015.
12. Allen J, Anderson DR, Baun B, et al. Reflections on developments in health promotion in the past quarter century from founding members of the American Journal of Health Promotion Editorial Board. *Am. J. Health Promot.* 2011;25(4):ei-eviii.

13. Bellew B. Primary prevention of chronic disease in Australia through interventions in the workplace setting: a rapid review. *Sax Institute for the Chronic Disease Prevention Unit, Victorian Government Department of Human Services.* 2008.

14. World Health Organization. Jakarta Statement on Healthy Workplaces. Available at http://www.who.int/healthpromotion/conferences/previous/jakarta/statements/workplaces/en/ Accessed on June 2013. 1997.

15. World Health Organization. Jakarta Declaration on Leading Health Promotion into the 21st Century. Available at http://www.who.int/healthpromotion/conferences/previous/jakarta/declaration/en/ Accessed on May 2015. 1997.

16. World Health Organization - Regional Office for the Western Pacific. Regional guidelines for the development of healthy workplaces. Available at http://www.who.int/occupational_health/regions/en/oehwproguidelines.pdf?ua=1 Accessed March 2015. Mania, WHO-WPRO1999.

17. World Health Organization. WHO's Global Healthy Work Approach; Document (HPR/HEP/97.2). In: Division of Health promotion EaCaOoOH, ed. Geneva1997.

18. de Greef MVDB, K.,. *Healthy Employees in Healthy Organisations: Making the case for workplace health promotion - Report. Avaialble at http://www.enwhp.org/good-whp-practice/about-whp/the-case-for-whp.html.* Germany: European Network for Workplace Health Promotion; 2004.

19. Brugge D. Community research in environmental health: studies in science, advocacy and ethics. *Guest Editors.* 2006;17(3):268.

20. Stason W. Measuring the" payoff" of worksite health strategies. *Bus. Health.* 1984;1(4):19.

21. Messner W. *Making the Compelling Business Case: Decision Making Techniques for Successful Business Growth.* Houndmills: Palgrave Macmillan; 2013.

22. Benach J, Muntaner C, Solar O, Santana V, Quinlan M. Introduction to the WHO Commission on Social Determinants of Health Employment Conditions Network (EMCONET) study, with a glossary on employment relations. *Int. J. Health Serv.* 2010;40(2):195-207.

23. O'Donnell MP, Ainsworth TH. Health Promotion in the Workplace. *AJN The American Journal of Nursing.* 1984;84(12):1484.

24. Allen RF, Allen J. A sense of community, a shared vision and a positive culture: core enabling factors in successful culture based health promotion. *Am. J. Health Promot.* Winter 1987;1(3):40-47.

25. Wenzel E. *Chapter 15 Conceptual issues in worksite health promotion; in Ecological public health: from vision to practice.* Centre for Health Promotion, University of Toronto: ParticipACTION; 1994.

26. Hemingway H, Nicholson A, Stafford M, Roberts R, Marmot M. The impact of socioeconomic status on health functioning as assessed by the SF-36 questionnaire: the Whitehall II Study. *Am. J. Public Health.* Sep 1997;87(9):1484-

1490.

27. Black CM, Great Britain. Health Work Wellbeing. Working for a healthier tomorrow : Dame Carol Black's review of the health of britain's working age population : presented to the Secretary of State for Health and the Secretary of State for Work and Pensions; available at http://www.dwp.gov.uk/docs/hwwb-working-for-a-healthier-tomorrow.pdf. 2008; 125 p. Available at.
28. Anderson DR, Serxner SA, Gold DB. Conceptual framework, critical questions, and practical challenges in conducting research on the financial impact of worksite health promotion. *Am. J. Health Promot.* May-Jun 2001;15(5):281-288.
29. Buck Consultants LLP. *Working Well: A Global Survey of Health Promotion,Workplace Wellness and Productivity Strategies, .* sixth edition, July 2014.
30. Arrow KJ. Uncertainty and the welfare economics of medical care. *The American economic review.* 1963:941-973.
31. Clarke P. Edgar Sydenstricker: The first health economist? Paper presented at: International Health Economics Association 9th World Congress on Health Economics: Celebrating Health Economics; 7-10 July, 2013; Sydney, Australia.
32. Getzen T. Sir William Petty: The First Health Economist by Number, Weight and Measure. International Health Economics Association 9th World Congress on Health Economics: Celebrating Health Economics; 10 July, 2013; Sydney, Australia.
33. Mushkin SJ. Toward a definition of health economics. *Public Health Rep.* Sep 1958;73(9):785-793.
34. World Bank. Health Systems Development. Health Economics Available at http://www.worldbank.org/en/topic/health. 2001.
35. Drummond MF, Sculpher MJ, Torrance GW. *Methods for the economic evaluation of health care programmes 3rd edition.* Oxford University Press, USA; 2005.
36. Wonderling DG, R. and Black, N.,. *Introduction to Health Economics in Understanding Public Health: London School of Hygiene & Tropical Medicine.* Open University Press McGraw-Hill Education; 2005.
37. Williams A. Health Economics: the cheerful face of a dismal science. In: Williams A, ed. *Health and Economics*. London: Macmillan; 1987.
38. Weinstein MC, Siegel JE, Gold MR, Kamlet MS, Russell LB. Recommendations of the Panel on Cost-effectiveness in Health and Medicine. *JAMA.* Oct 16 1996;276(15):1253-1258.
39. McIntosh E, Clarke P, Frew E, Louviere J. *Applied methods of cost-benefit analysis in health care.* Vol 4: OUP Oxford; 2010.
40. Mauskopf JA, Paul JE, Grant DM, Stergachis A. The Role of Cost—Consequence Analysis in Healthcare Decision—Making. *Pharmacoeconomics.* 1998;13(3):277-288.
41. Nixon J, Stoykova B, Glanville J, Christie J, Drummond M, Kleijnen J. The U.K. NHS

economic evaluation database. Economic issues in evaluations of health technology. *Int. J. Technol. Assess. Health Care.* Summer 2000;16(3):731-742.

42. McDaid DN, J. *What use has been made of economic evaluation in public health? A systematic review of the literature.* Dawson, S. Morris, ZS. editors Future Public Health: Burdens, Challenges and Opportunities. Basingstone: Palgrave Macmillan 2009. p 248-64.

43. National Institute for Health and Clinical Excellence. Methods for development of NICE public health guidance. Second edition NICE London. Available at http://www.nice.org.uk/media/2FB/53/PHMethodsManual110509.pdf Accessed May 2015. 2009.

44. National Institute for Health and Clinical Excellence. *The Guidelines Manual: Chapter 8; Incorportaing health economics in guidelines and assessing resource impact (April 2007)* *http://www.nice.org.uk/niceMedia/pdf/GuidelinesManualChapter8.pdf.* 2007.

45. Warner KE, Wickizer TM, Wolfe RA, Schildroth JE, Samuelson MH. Economic implications of workplace health promotion programs: review of the literature. *J. Occup. Med.* Feb 1988;30(2):106-112.

46. Uegaki K, de Bruijne MC, van der Beek AJ, van Mechelen W, van Tulder MW. Economic Evaluations of Occupational Health Interventions from a Company's Perspective: A Systematic Review of Methods to Estimate the Cost of Health-Related Productivity Loss. *Journal of Occupational Rehabilitation.* Mar 2011;21(1):90-99.

47. Lerner D, Rodday AM, Cohen JT, Rogers WH. A Systematic Review of the Evidence Concerning the Economic Impact of Employee-Focused Health Promotion and Wellness Programs. *J. Occup. Environ. Med.* 2013;55(2):209-222.

48. Sockoll IK, I. and Boedeker, W. Effectiveness and economic benefits of workplace health promotion and prevention: Summary of the scientific evidence 2000-2006 IGA-Report 13e Available at http://www.enwhp.org/publications/other-publications.html Accessed April 2015.

49. CRD N. NHS Centre for Reviews and Dissemination. *Undertaking systematic reviews of research on effectiveness.* 2001.

50. Database of Abstracts of Reviews of Effects. available http://www.crd.york.ac.uk/crdweb/ (accessed October 2011).

51. Shemilt I MM, Vale L, Marsh K, Donaldson C (editors). *Evidence-based decisions and economics : health care, social welfare, education and criminal justice.* 2nd ed. Chichester, West Sussex, UK ; Hoboken, NJ: Wiley-Blackwell/BMJ Books; 2010.

52. Campbell and Cochrane Economics Methods Group. Campbell and Cochrane Economics Methods Group, How to add Health Economics to Cochrane Protocols Available from http://www.c-cemg.org/ [Accessed October 10, 2011].

53. Campbell and Cochrane Economics Methods Group. Cochrane Handbook; Chapter 15: Incorporating economics evidence, 15.5.2 Critical appraisal of methodological quality in http://www.cochrane-handbook.org Assessed on 10 October, 2011.

54. Drummond MF, Jefferson TO. Guidelines for authors and peer reviewers of economic submissions to the BMJ. The BMJ Economic Evaluation Working Party. *BMJ.* Aug 3 1996;313(7052):275-283.

55. Evers S, Goossens M, de Vet H, van Tulder M, Ament A. Criteria list for assessment of methodological quality of economic evaluations: Consensus on Health Economic Criteria. *Int. J. Technol. Assess. Health Care.* Spring 2005;21(2):240-245.

56. Philips Z, Bojke L, Sculpher M, Claxton K, Golder S. Good practice guidelines for decision-analytic modelling in health technology assessment: a review and consolidation of quality assessment. *Pharmacoeconomics.* 2006;24(4):355-371.

57. National Institute for Health and Clinical Excellence. The Guidelines Manual: Appendix H: Methodology checklist - economic evaluations (January 2009) http://www.nice.org.uk/media/633/71/The_guidelines_manual_2009_-_Appendix_H_Methodology_checklist_-_economic_evaluations.pdf. 2009.

58. Chiou CF, Hay JW, Wallace JF, et al. Development and validation of a grading system for the quality of cost-effectiveness studies. *Med. Care.* Jan 2003;41(1):32-44.

59. Ofman JJ, Sullivan SD, Neumann PJ, et al. Examining the value and quality of health economic analyses: implications of utilizing the QHES. *Journal of Managed Care Pharmacy.* 2003;9(1):53-61.

60. Oxman A, Group GW. Grading quality of evidence and strength of recommendations. *BMJ.* 2004;328(19):1490-1494.

61. Husereau D DM, Petrou S, et al. Consolidated health economic evaluation reporting standards (CHEERS)—Explanation and elaboration: A report of the ISPOR health economic evaluations publication guidelines good reporting practices task force. *Value Health 2013;16:231-50.* 2013.

62. World Health Organization. Evaluation in Health Promotion; Principles and Perspectives. WHO Regional Publications, European Series, No 92 Available at http://www.euro.who.int/en/publications/abstracts/evaluation-in-health-promotion.-principles-and-perspectives Accessed on May 2013. 2001.

63. Mossink JadG, M.,. *Inventory of socioeconomic costs and work accidents European Agency for Safety and Health at Work Available at https://www.osha.europa.eu/en/publications/reports/207 Accessed on May 2015.* Luxembourg: Office for Official Publications of the European Communities2002.

64. Tugwell P, Bennett KJ, Sackett DL, Haynes RB. The measurement iterative loop: a framework for the critical appraisal of need, benefits and costs of health interventions. *J. Chronic Dis.* 1985;38(4):339-351.

65. Downey AM, Sharp DJ. Why do managers allocate resources to workplace health promotion programmes in countries with national health coverage? *Health Promot Int.* 2007;22(2):102-111.

66. Australian Government Department of Health and Aging. National Partnership on Preventive Health (NPAPH) statement of commitment available at: http://www.healthyworkers.gov.au/internet/hwi/publishing.nsf/Content/joint-

statement-toc.

67. Australian National Preventive Health Agency (ANPHA). *State of Preventive Health 2013. Report to the Australian Government Minister of Health.* Canberra; ANPHA2013.

68. Premier's Physical Activity Council. Get Moving at Work: A resource kit for workplace health and wellbeing programs Available at www.getmoving.tas.gov.au Accessed August 2014. 2007.

69. Tasmanian Department of Health and Human Services (DHHS). Connecting care: Chronic Disease Action Framework for Tasmania 2009–2013 Available at http://www.dhhs.tas.gov.au/__data/assets/pdf_file/0006/48390/Connecting_Care_Full_Version_web.pdf Accessed Nov 2014. 2009.

70. Tasmanian Government Department of Health and Human Services. Working in Health Promoting Ways: a Strategic Framework Available at http://www.dhhs.tas.gov.au/healthpromotion/wihpw Accessed May 2015. 2010.

71. Tasmanian Government Premier's Physical Activity Council. Tasmania's Plan for Physical Activity 2011-2021. Developed in consultation with the Tasmanian Community. Available at http://www.getmoving.tas.gov.au/__data/assets/pdf_file/0010/51112/TPPA_A4_LOW_RES.pdf Accessed May 2015. 2011.

72. Tasmanian Government Department of Health and Human Services with Australian Network for Promotion, Prevention and Early Intervention for Mental Health (Auseinet) University of Canberra,. Building the Foundations: Strategic Framework Available at http://www.dhhs.tas.gov.au/mentalhealth/publications/strategic_documents Accessed March 2013. 2009.

73. Australian Government Geoscience Australia. Area of Australia - States and Territories Availabel at http://www.ga.gov.au/scientific-topics/geographic-information/dimensions/area-of-australia-states-and-territories Accessed on 5 May 2015.

74. Australian Bureau of Statistics. *State and Territory Statistical Indicators Cat. No. (1367.0).* Canberra ACT: ABS2011.

75. Tasmanian Government Department of Premier and Cabinet PSMO. *People Directions: delivering quality services for Tasmanians.* Hobart, Tasmania2009.

76. Queensland Health. Better health for Working People: Guidling Principles. In: QLD Health, ed. Brisbane, Australia1996.

77. Workplace Health and Safety Queensland. Healthy Lifestyle Program for the Queensland Public Service: Guidelines for government agencies. Available at www.worksafe.qld.gov.au Accessed on August 2014. 2008.

78. Griffith University Centre for Population and Environmental Health. HealthyWork Professional Development Course Guide. 2010.

79. Tasmanian State Government Department of Premier and Cabinet. Ministerial

Direction 23 Guidelines; Implementing a Workplace Health and Wellbeing Program Available at http://www.dpac.tas.gov.au/__data/assets/pdf_file/0006/123855/Ministerial_Direction_23_Guidelines.pdf Accessed on 15 November, 2014.

80. Tasmanian Government Department of Premier and Cabinet PSMO. *Healthy@Work Strategic Plan.* Hobart, Tasmania2009.

81. Shemilt, I. Mugford, M. Byford, S. Drummond, M. et al on behalf of the Campbell and Cochrane Economics Methods Group. *Incorporating economics evidence. In: Higgins JPT, Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from* www.cochrane-handbook.org

82. Brazier J, Roberts J, Deverill M. The estimation of a preference-based measure of health from the SF-36. *J. Health Econ.* Mar 2002;21(2):271-292.

83. Wooden M, Watson N. The HILDA Survey and its Contribution to Economic and Social Research (So Far). *Econ. Rec.* 2007;83(261):208-231.

84. Watson N, Wooden M. The HILDA Survey four years on. *Australian Econ. Rev.* 2004;37(3):343-349.

85. Butterworth P, Crosier T. The validity of the SF-36 in an Australian National Household Survey: demonstrating the applicability of the Household Income and Labour Dynamics in Australia (HILDA) Survey to examination of health inequalities. *BMC public health.* 2004;4(1):44.

86. de Salazar L, Jackson S, Shiell A, Rice M. Guide to economic evaluation in health promotion. *Washington: Pan American Health Organization.* 2007.

Appendix 1A: First recorded health economic evaluation

"Of Lessening y^{e} Plagues of London"

A plan presented October 7, 1667, by Sir William Petty

1. London with ye bills hath 696 th(ousand) in 108th(ousand) houses.
2. In pestilentiall yeares, (which are one in 20) there dye 1/6th of ye people of plague and 1/5th of all diseases.
3. The remedies against spreading of ye plague are shutting up suspected houses and pest-houses within 1/2 mile of ye citty.
4. In a circle about ye center of London of 35 miles semi-diameter, or a dayes journey, there live as many people and are as many houses as in London.
5. Six heads may be bee caryd a days journey for 20 sh(illings).
6. A family may bee lodged 3 months in ye country for 4sh(illings), so as ye charge of carying out and lodging a family at a medium will be 5 sh(illings).
7. In ye greatest plague we feare, scarce 20th(ousand) families will bee infected; and in this new method but 10th(ousand), ye charge whereof will be 50th(ousand) pounds.
8. The Pople which ye next plague of London will sweep away will be proably 120th(ousand), which at 7 pounds per head is a losse of 8,400 th(ousands), the half whereof is 4,200th(ousands).
9. So as 50 is ventured to save 4,200, or about one for 84.
10. There never was a Plague in ye campagne of England by which 1/6th of ye people dyed.
11. Poore people who live close dye most of ye plague.
12. The Plague is about 3 monthes rising and as much falling, which colc weather hastens.
13. Killing dogs, making great fires in yet street, nor the use of midicaments are considered sure, for which everyone by common directions may bee theire owne Physicians.
14. In ye circle of 70 miles diameter, choose 10 large wide roomey disjoyned houses with water and garden to each, the Inhabitants to remove at 7 days notice.
15. Convenient wagons of coaches to bee prepared to carry away ye suspected.
16. A method to furnish ye pesthouses with medicines for their mony.
17. Books of devotion for every house.

Proposalls---when 100 per week dy, the Plague is begun. If there dye fewer than 120th(ousands), out of ye bills, of all diseases within a yeare after, then W(illiam) P(etty) is to have 20sh(illings) per head for all lesse, and to pay 10sh(illings) per head for all above it. Every family removed being to provide 10 pounds for ye charge of going and coming and for 4 monthes rent. Or a gratuity of with W(illiam) P(etty) his insurance.

From Lord Edmond Fitzmaurice's *The Life of Sir William Petty*, 1895 pp. 121-122, reprinted as a footnote to page 109 in *The Economic Writings of Sir William Petty* by Charles Henry Hull Cornell University Press(?) 1899, reprinted by A.M. Kelley, New York, 1963. Kindly provided by Professor Thomas E. Getzen; Executive Director, International Health Economics Association (iHEA).

Appendix 1B: Summary of the types of economic evaluations relevant for work presented in this thesis

Types of analysis	Assessment of Costs (C) and Benefits (B)	Characteristics	Types of questions it can address	Strengths	Challenges
Cost Benefit Analysis (CBA)	(C) Monetary Units (B) Monetary Units	A method designed to value and compare all of the costs (C) and benefits (B) of interventions in equivalent monetary terms. It provides an absolute indicator of the 'worth' of the intervention. An intervention should be implemented only if B-C>0 or if B/C>1.	Allocation efficiency Is the goal worth achieving? Which was worthwhile?	Makes it possible to compare programs that generate different types of outcomes—within the health sector and outside of it	Difficult to assign a monetary value to the outcomes of the intervention Ethical issues about assigning a monetary value to improvements in well-being of individuals
Cost Effectiveness Analysis (CEA)	(C) Monetary Units (B) Natural Health Units or outcome of effectiveness (E), including Disability Adjusted Life Years (DALY)	This method traditionally considers a single measure of output. It allows comparisons among options with the same indicator of effect An intervention with a lower C/E ratio is usually preferable to one with higher C/E ratio	Production efficiency How effective was X at producing health change for a reasonable cost (relative to Y)?	Comparison of health outcomes are helpful for health decision-makers. Interventions of same type competing for same resources can be compared.	Only interventions that have outcomes in the same measuring units can be compared. Limited to single dimension of effectiveness so it cannot capture the multidimensional outcomes of most workplace health promotion programs
Cost Utility	(C) Monetary	This is a variant of CEA.	Production efficiency	Provides a common	No validated measure of

Appendix 1B: Summary of the types of economic evaluations relevant for work presented in this thesis

Analysis (CUA)	Units (B) Healthy Years; Quality Adjusted Life Years (QALY)	Benefits incorporate length of life and quality of life. The analysis requires a preference based health-related measure known as a multi-attribute health utility instrument (MAUI).	How effective was X at producing life year change for a reasonable cost (relative to Y)?	outcome measure so evaluators can compare interventions with broad ranges of outcomes and from different sectors	health-related utility in workplace health promotion (Refer to Chapter 4). Often workplace health promotion interventions have additional benefits beyond health gain. A measure of health utility may be insensitive to changes in relatively 'healthy' populations. Effects may not be captured due to health benefit latency in workplace health promotion
Cost Consequence Analysis (CCA)	(C) Monetary Units (B) Natural Units (as in CEA), not restricted to a single outcome	This is a variant of CEA. It sets out a profile of all important changes so that none may be overlooked	Pragmatic efficiency How effective was X (intervention) relative to the importance of Y (the outcomes of interest)?	It ensures that all outcomes of importance are acknowledged	It can be difficult to determine whether an intervention provides value for money, as value is implicit, priorities and preferences differ and some outcomes improve while others worsen

Adapted from de Salazar et.al (2007)[86]

Appendix 1C: *partnering*Healthy@Work survey 2010

ID NUMBER: ________________

HEALTHY @ WORK QUESTIONNAIRE

This questionnaire asks for some general information about you, as well as some information about your physical and emotional health, your diet and physical activity, and your employment.

Instructions: Please read carefully

You will notice that some questions are the same or similar to ones you may have answered in other questionnaires - it is important to answer these.

Please answer all questions to the best of your ability (leave blank if unknown).

Your answers will be completely confidential.

Indicate your response by filling in the circle next to the most appropriate answer,

Example:

Shade circles like this ●

Not like this ⨂ or ✓

Cross out mistakes like this ✱

or by writing clearly using the boxes where provided.
Please use BLOCK LETTERS where required.

Example: | |2|/|1|2|/|2|0|0|9|

Cross out any mistakes and write the correct answer just below the relevant boxes.

Please use a black or blue pen if possible.

2

SECTION A

This section asks you some general questions about yourself.

1. **Today's date:** ☐☐ / ☐☐ / ☐☐ (dd/mm/yy)
2. **Your date of birth:** ☐☐ / ☐☐ / ☐☐ (dd/mm/yy)
3. **What is your sex?** O Male O Female
4. **What is your current marital status?**
   - O Single
   - O Married
   - O De facto
   - O Separated/Divorced
   - O Widowed
5. **What is the highest level of education you have completed? (Select only one)**
   - O Primary school
   - O Year 7, 8 or 9 or equivalent
   - O Year 10 or equivalent
   - O Year 12 or equivalent
   - O Trade/apprenticeship *(e.g. hairdresser, chef)*
   - O Certificate/diploma *(e.g. child care, technician)*
   - O University degree
   - O Higher university degree *(e.g. Grad Dip, Masters, PhD)*
6. **Please tell us when you first started working in the Tasmanian state service. If you don't know the exact date, please indicate month and year.**

   ☐☐ / ☐☐ / ☐☐ (dd/mm/yy)
7. **What part of your Agency/Department do you currently work in?**

   ____
8. **How many people are employed at your workplace (the immediate workplace, office, work unit, or team where you spend the largest proportion of your time at work)? If you don't know for sure please give your best estimate.**
   - O 0-10
   - O 11-20
   - O 21-50
   - O 51-100
   - O 101-200
   - O More than 200

9. **Which of these categories *best* describes your contract of employment?**
   - O Employed on a fixed-term contract
   - O Employed on a casual basis
   - O Employed on a permanent or ongoing basis
   - O Other (please specify) ____________________

10. **What is your <u>main</u> occupation NOW? (Select only one answer)**
   - O Manager or administrator *(e.g. magistrate, farm manager, general manager, director of nursing, school principal)*
   - O Professional *(e.g. scientist, doctor, registered nurse, allied health professional, teacher)*
   - O Associate professional *(e.g. technician, manager, youth worker, police officer)*
   - O Tradesperson or related worker *(e.g. carpenter, gardener)*
   - O Advanced clerical or service worker *(e.g. secretary, personal assistant, law clerk)*
   - O Intermediate clerical, sales or service worker *(e.g. typist, word processing/data entry operator, receptionist, child care worker, nursing assistant, hospitality worker)*
   - O Intermediate production or transport worker *(e.g. machine operator, bus driver)*
   - O Elementary clerical, sales or service worker *(e.g. filing/mail clerk, sales assistant)*
   - O Labourer or related worker *(e.g. cleaner, general farm hand, kitchen hand)*

11. **a) What would you say is the single most important thing you personally could do to improve your health or reduce your risk of getting sick? Write on the line below.**

____

b) For this change, which one applies to you now?
   - O I am not thinking of making this change
   - O I am thinking about making this change, but not in the next fortnight
   - O I am thinking about making this change in the next fortnight or so
   - O I am trying to make this change at the moment

4

SECTION B

These questions are about your diet and smoking tobacco.

1. How many serves of vegetables (excluding potatoes) do you usually eat each day? ***(One serve = ½ cup cooked vegetables or 1 cup of salad vegetables)***

O 1 serve O 2 serves O 3 serves O 4 serves O 5 serves O 6 or more serves

O Don't eat vegetables

2. How many serves of fruit do you usually eat each day? ***(One serve = 1 medium piece of fruit or 1 cup of diced pieces)***

O 1 serve or less O 2 serves O 3 serves O 4 or more serves

O Don't eat fruit

3. How many times do you eat red meat in an average week, including sausages, luncheon meat, salamis, meat pies, hamburger or bacon (but not including fish or poultry)?

O Ten or more times per week
O Five to nine times a week
O Three to four times a week
O Once or twice a week
O Less than once a week
O Never

4. How often do you eat fish or seafood in an average week?

O Six or more times a week
O Three to five times a week
O Once or twice a week
O Less than once a week
O I never eat fish for medical reasons
O I never eat fish for religious or ethical reasons
O I never eat fish for other reasons *(please specify)*__________

5. How many times per week would you usually eat hot takeaway meals? (e.g. pizza, burgers, fried or roast chicken, Chinese/Indian/Thai takeaway)

O Don't eat takeaway
O 1 meal or less per month
O 1 meal per week
O 2-3 meals per week
O 4-5 meals per week
O 6-7 or more meals per week

5

6. What type of milk do you usually consume?

- O Condensed
- O Full cream (normal milk)
- O Almost equal amounts of full cream and reduced fat
- O Reduced fat
- O Skim
- O None
- O Other *(please specify)*____________________

7. How often do you add salt to your food after it is cooked?

- O Never
- O Rarely
- O Sometimes
- O Almost always
- O Always

8. How often do you have a drink containing alcohol?

- O Never **(skip to Q.11)**
- O Monthly or less
- O 2 to 4 times a month
- O 2 to 3 times a week
- O 4 or more times a week

9. How many standard drinks do you have on a typical day when you are drinking? *(Please refer to the Standard Drink Guide on the next page for examples of standard drinks).*

- O 1 or 2
- O 3 or 4
- O 5 or 6
- O 7 to 9
- O 10 or more

10. How often do you have 5 or more standard drinks on one occasion?

- O Never
- O Less than monthly
- O Monthly
- O Weekly
- O Daily or almost daily

11. Over your lifetime, have you smoked at least 100 cigarettes or a similar amount of tobacco?

O Yes **(Answer Q.12)**   O No **(Skip to Section C)**

12. Have you ever been a daily smoker?

O Yes   O No **(Skip to Section C)**

12a) At what age did you start smoking daily?

☐☐ years

12b) How often do you now smoke cigarettes, cigars, pipes or any other tobacco products?

- O Daily **(Skip to Section C)**
- O At least weekly (but not daily)
- O Less often than weekly
- O Not at all

12c) At what age did you finally stop smoking daily?

☐☐ years

Standard Drink Guide

Source: Australian Government Department of Health and Ageing

SECTION C

These questions are about your current physical activities.

The following questions will ask you about the time you spent being physically active in the last 7 days. Please think about the activities you do at work, as a part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Please answer each question even if you do not consider yourself to be an active person.

Think about all the **vigorous** and **moderate** activities that you did in the **last 7 days**.

- **Vigorous** physical activities refer to activities that take **hard** physical effort and make you breathe much harder than normal.

- **Moderate** activities refer to activities that take moderate physical effort and make you breathe **somewhat** harder than normal.

PART 1: WORK-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home.

Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. We ask about these in Part 3.

13. Do you currently have a job or do any unpaid work outside your home?

O Yes
O No → ***Skip to PART 2: TRANSPORTATION***

The next questions are about all the physical activity you did in the last 7 days as part of your paid or unpaid work. This does not include travelling to and from work.

14. During the **last 7 days**, on how many days did you do vigorous physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**? Think about only those physical activities that you did for **at least 10 minutes** at a time.

_____ **days per week**

O No vigorous job-related physical activity → ***Skip to question 4***

15. How much time did you usually spend on one of those days doing vigorous physical activities as part of your work?

_____ **hours per day**
_____ **minutes per day**

8

16. Again, think about only those physical activities that you did for **at least 10 minutes** at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads as part of your work? *Please DO NOT include walking.*

_____ **days per week**

O No moderate job-related physical activity → ***Skip to question 6***

17. How much time did you **usually** spend on one of those days doing **moderate** physical activities as part of your work?

_____ **hours per day**
_____ **minutes per day**

18. During the last 7 days, on how many days did you walk for **at least 10 minutes** at a time as part of your work? Please do not count any walking you did to travel to, or from work.

_____ **days per week**

O No job-related walking → ***Skip to PART 2: TRANSPORTATION***

19. How much time did you usually spend on **one** of those days **walking** as part of your work?

_____ **hours per day**
_____ **minutes per day**

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you travelled from place to place, including to places like work, stores, movies, and so on.

20. During the last 7 days, on how many days did you travel **in a motor vehicle** like a train, bus, car, or tram?

_____ **days per week**

ONo travelling in a motor vehicle → ***Skip to question 10***

21. How much time did you **usually** spend in a motor vehicle on **one** of those days?

_____ **hours per day**
_____ **minutes per day**

Now think only about the cycling and walking you might have done to travel to and from work, to do errands, or to go from place to place.

22. During **the last 7 days**, on how many days did you **cycle** for **at least 10 minutes** at a time to go from place to place?
_____ **days per week**

ONo bicycling from place to place → ***Skip to question 12***

23. How much time did you usually spend on **one** of those days **cycling** from place to place?

_____ **hours per day**
_____ **minutes per day**

24. During the last 7 days, on how many days did you **walk** for **at least 10 minutes** at a time to go from place to place?

_____ **days per week**

O No walking from place to place → ***Skip to PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY***

25. How much time did you usually spend on **one** of those days **walking** from place to place?

_____ **hours per day**
_____ **minutes per day**

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the last 7 days in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

YARD WORK:

26. Think about only those physical activities that you did for at **least 10 minutes** at a time. During **the last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, chopping wood, shovelling snow, or digging in the garden or yard?

_____ **days per week**

O No vigorous activity in garden or yard → ***Skip to question 16***

27. How much time did you usually spend on **one** of those days doing **vigorous** physical activities **in the garden or yard?**

_____ **hours per day**
_____ **minutes per day**

28. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking **in the garden or yard**?

_____ **days per week**

O No moderate activity in garden or yard → ***Skip to question 18***

29. How much time did you usually spend on one of those days doing **moderate** physical activities **in the garden or yard?**

_____ **hours per day**
_____ **minutes per day**

HOUSEWORK

30. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside your home**?

_____ **days per week**

O No moderate activity inside home → ***Skip to PART 4: RECREATION, SPORT AND LEISURE-TIME PHYSICAL ACTIVITY***

31. How much time did you usually spend on one of those days doing **moderate** physical activities **inside your home?**

_____ **hours per day**
_____ **minutes per day**

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the last 7 days solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

32. Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?

_____ **days per week**

O No walking in leisure time → ***Skip to question 22***

33. How much time did you usually spend on one of those days **walking** in your leisure time?

_____ **hours per day**
_____ **minutes per day**

34. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time**?

_____ **days per week**

O No vigorous activity in leisure time → ***Skip to question 24***

35. How much time did you usually spend on one of those days doing **vigorous** physical activities in your leisure time?

_____ **hours per day**
_____ **minutes per day**

36. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis **in your leisure time**?

_____ **days per week**

O No moderate activity in leisure time ➔ ***Skip to PART 5: TIME SPENT SITTING***

37. How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time?

_____ **hours per day**
_____ **minutes per day**

PART 5: TIME SPENT SITTING

These last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television.
Do not include any time spent sitting in a motor vehicle that you have already told us about.

38. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekday**?

_____ **hours per day**
_____ **minutes per day**

39. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekend day**?

_____ **hours per day**
_____ **minutes per day**

SECTION D

This section is about your health.

1. **How tall are you without shoes?** ☐☐☐ cm **OR** ☐☐ ft ☐☐ in

2. **(Females only) Are you currently pregnant?** O Yes **(Skip to Q.5)** O No

3. **How much do you weigh?** ☐☐☐ kg **OR** ☐☐ st ☐☐ lb

4. **How much would you like to weigh now? (Select only one)**

O Happy as I am
O 1 – 5 kg more
O Over 5 kg more
O 1 – 5 kg less
O 6 – 10 kg less
O Over 10 kg less

The following questions ask for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities.

5. **In general, would you say your health is:**

O Excellent O Very good O Good O Fair O Poor

6. **The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?**

		YES, limited a lot	YES, limited a little	NO, not limited at all
6a)	Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	O	O	O
6b)	Climbing several flights of stairs	O	O	O

7. **During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?**

		All of the time	Most of the time	Some of the time	A little of the time	None of the time
7a)	Accomplished less than you would like	O	O	O	O	O
7b)	Were limited in the kind of work or other activities	O	O	O	O	O

8. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
8a) Accomplished less than you would like.	○	○	○	○	○
8b) Did work or other activities less carefully than usual	○	○	○	○	○

9. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
○	○	○	○	○

10. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the **past 4 weeks:**	All of the time	Most of the time	Some of the time	A little of the time	None of the time
10a) Have you felt calm and peaceful?	○	○	○	○	○
10b) Did you have a lot of energy?	○	○	○	○	○
10c) Have you felt downhearted and depressed?	○	○	○	○	○

11. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
○	○	○	○	○

12. Do you currently have any of the following conditions?

		Yes	No
a)	Arthritis or rheumatism	O	O
b)	Chronic back pain	O	O
c)	Migraine headaches	O	O
d)	Other frequent or severe headaches	O	O
e)	Any other chronic pain	O	O
f)	High blood pressure or hypertension	O	O
g)	Congestive heart failure	O	O
h)	Coronary heart disease	O	O
i)	High blood cholesterol	O	O
j)	An ulcer in your stomach or intestine	O	O
k)	Irritable bowel disorder	O	O
l)	Chronic heart burn or gastroesophageal reflux disease	O	O
m)	Asthma	O	O
n)	Chronic bronchitis or emphysema	O	O
o)	Seasonal allergies or hay fever	O	O
p)	Chronic Obstructive Pulmonary Disease	O	O
q)	Urinary or bladder problems	O	O
r)	Diabetes	O	O
s)	Obesity	O	O
t)	Chronic sleeping problems	O	O
u)	Chronic fatigue or low energy	O	O
v)	Osteoporosis	O	O
w)	Skin cancer	O	O
x)	Any other type of cancer	O	O

13. How many times in the last 12 months have you been admitted <u>overnight or longer</u> in any hospital for any reason?

☐☐ times

14. In the past 12 months, how many nights <u>in total</u> did you stay in hospital?

☐☐ nights

The following ten questions ask about how you have been feeling in the last four weeks. For each question, fill in the circle under the option that best describes the amount of time you felt that way.

		None of the time	A little of the time	Some of the time	Most of the time	All of the time
15.	In the past 4 weeks about how often did you feel tired out for no good reason?	O	O	O	O	O
16.	In the past 4 weeks about how often did you feel nervous?	O	O	O	O	O
17.	In the past 4 weeks about how often did you feel so nervous that nothing could calm you down?	O	O	O	O	O
18.	In the past 4 weeks about how often did you feel hopeless?	O	O	O	O	O
19.	In the past 4 weeks about how often did you feel restless or fidgety?	O	O	O	O	O
20.	In the past 4 weeks about how often did you feel so restless you could not sit still?	O	O	O	O	O
21.	In the past 4 weeks about how often did you feel depressed?	O	O	O	O	O
22.	In the past 4 weeks about how often did you feel that everything was an effort?	O	O	O	O	O
23.	In the past 4 weeks about how often did you feel so sad that nothing could cheer you up?	O	O	O	O	O
24.	In the past 4 weeks about how often did you feel worthless?	O	O	O	O	O

SECTION E

These questions are about your *current* job with the Tasmanian state service.

1. **On which days of the week to you usually work?**

   - O Five days a week Monday to Friday
   - O Days vary from week to week
   - O Other – please specify days below
     - O Monday O Tuesday O Wednesday O Thursday O Friday O Saturday O Sunday

2. **Which of the following options best describe your current work schedule? Please tick all that apply**

   - O A regular daytime schedule
   - O A regular evening shift
   - O A regular night shift
   - O A rotating shift (changes from days to evenings to nights)
   - O Split shift (two distinct periods per day)
   - O On call
   - O Irregular schedule
   - O Other – please specify ____________________

3. **Including any paid or unpaid overtime, how many hours per week do you usually work?**
   This includes any work done at the workplace and at home. Don't include time 'on-call'.

   ☐☐ hours per week

4. **If you could choose the number of hours you work each week, *and taking into account how that would affect your income*, would you prefer to work:**

   - O Fewer hours than you do now?
   - O About the same hours as you do now?
   - O More hours than you do now?

5. **How many days in the last 4 weeks have you stayed away from your work for more than half the day because of health problems?**

   ☐☐ days

6. **How many days in the last 4 weeks did you go to work while suffering from health problems?**

   ☐☐ days

7. **On these days when you went to work suffering from health problems, what percentage of your time were you as productive as usual? For example, if you were exactly as productive as usual please mark '100 %'.**

   Please indicate the percentage with a vertical line on the scale below.

   |——————————————————————————|
   0% 20% 40% 60% 80% 100%

8. **Please indicate which of the following workplace health and wellbeing activities/ programs were available at <u>your</u> workplace in the past 12 months. For those that are "Yes", please indicate <u>how many times</u> you personally participated.**

		Available in past 12 months: No	Available in past 12 months: Yes	Number of times you participated in the past 12 months. Please enter a number.
a)	Health information seminars or workshops	O	O →	☐☐
b)	Organisation nutrition policy	O	O →	☐☐
c)	Organisation physical activity policy	O	O →	☐☐
d)	Other health/wellbeing policies (e.g. smoking)	O	O →	☐☐
e)	Organisation sport team / sport or activity days	O	O →	☐☐
f)	Employee Assistance Program	O	O →	☐☐
g)	Exercise or physical activity sessions	O	O →	☐☐
h)	Injury prevention or rehabilitation	O	O →	☐☐
i)	Allocated stretching or relaxing times	O	O →	☐☐
j)	Regular health assessments	O	O →	☐☐
k)	Cycle to work or walk to work activities / TravelSmart Workplace Program	O	O →	☐☐
l)	Regular fitness assessments	O	O →	☐☐
m)	Personal development opportunities for life skills	O	O →	☐☐
n)	Flu vaccination	O	O →	☐☐
o)	Stress management program or strategies	O	O →	☐☐
p)	Subsidised membership to off-site facilities/programs	O	O →	☐☐
q)	'Walk and talk' or active meetings	O	O →	☐☐
r)	Flexible work arrangements	O	O →	☐☐
s)	Other (please specify) ______________	O	O →	☐☐

9. In the past 12 months, did you spend any of your own money to take part in any of the above activities?

O No O Yes → Total amount you spent in dollars $☐☐☐

10. Please indicate the amenities that are available at your workplace. Choose all that apply.

- O Space to hold activities
- O Equipment storage areas
- O Lunch / break room
- O Onsite gymnasium / fitness centre
- O Shower and change facilities
- O Fruit baskets provided
- O Outdoor exercise areas for employees to use
- O Stairs / stair wells that can be used for exercise
- O Bulletin boards or newsletters where health information is provided
- O Healthy food options at work functions/meetings
- O Healthy food options in on-site canteens/vending machines
- O Other (please specify) ____________________

11. Please indicate whether you agree or disagree with the following statements.

In relation to the workplace health and wellbeing activities listed at Question 8:

		Strongly agree	Agree	Disagree	Strongly disagree
a)	I am supported by my supervisor to take part	O	O	O	O
b)	The activities on offer are of interest to me	O	O	O	O
c)	Management supports these activities	O	O	O	O
d)	My co-workers are not interested in taking part	O	O	O	O
e)	These activities improve employee morale	O	O	O	O
f)	My organisation places a high priority on these activities	O	O	O	O
g)	My health is not the responsibility of my employer	O	O	O	O
i)	I have trouble fitting these activities around my family/other commitments	O	O	O	O
j)	I am consulted in the design of these activities	O	O	O	O
k)	The activities do not fit in with the shifts I work	O	O	O	O
l)	Management actively participate in these activities	O	O	O	O
m)	I don't have the time to take part	O	O	O	O
n)	These activities can improve my health and wellbeing	O	O	O	O
o)	Employees should not be expected to contribute to the cost of these activities	O	O	O	O
p)	I would be more likely to take part if an incentive was offered	O	O	O	O
q)	My organisation supports a healthy balance of family and working life	O	O	O	O

The following items refer to your current job in the Tasmanian state service. For each of the following statements, please indicate to what degree it reflects your situation.
Thank you for answering all statements!

12. I have constant time pressure due to a heavy work load.
- Disagree........ O
- Agree, but I am not at all distressed........ O
- Agree, and I am somewhat distressed........ O
- Agree, and I am distressed........ O
- Agree, and I am very distressed........ O

13. I have many interruptions and disturbances while performing my job.
- Disagree........ O
- Agree, but I am not at all distressed........ O
- Agree, and I am somewhat distressed........ O
- Agree, and I am distressed........ O
- Agree, and I am very distressed........ O

14. I have a lot of responsibility in my job.
- Disagree........ O
- Agree, but I am not at all distressed........ O
- Agree, and I am somewhat distressed........ O
- Agree, and I am distressed........ O
- Agree, and I am very distressed........ O

15. I am often pressured to work overtime.
- Disagree........ O
- Agree, but I am not at all distressed........ O
- Agree, and I am somewhat distressed........ O
- Agree, and I am distressed........ O
- Agree, and I am very distressed........ O

16. My job is physically demanding.
- Disagree........ O
- Agree, but I am not at all distressed........ O
- Agree, and I am somewhat distressed........ O
- Agree, and I am distressed........ O
- Agree, and I am very distressed........ O

17. Over the past few years, my job has become more and more demanding.
- Disagree........ O
- Agree, but I am not at all distressed........ O
- Agree, and I am somewhat distressed........ O
- Agree, and I am distressed........ O
- Agree, and I am very distressed........ O

18. I receive the respect I deserve from my superiors.

Not applicable (no superiors)...................... O
Agree.. O
Disagree, but I am not at all distressed...... O
Disagree, and I am somewhat distressed... O
Disagree, and I am distressed.................... O
Disagree, and I am very distressed............ O

19. I receive the respect I deserve from my colleagues.

Not applicable (no colleagues)................... O
Agree.. O
Disagree, but I am not at all distressed...... O
Disagree, and I am somewhat distressed... O
Disagree, and I am distressed.................... O
Disagree, and I am very distressed............ O

20. I experience adequate support in difficult situations.

Agree.. O
Disagree, but I am not at all distressed...... O
Disagree, and I am somewhat distressed... O
Disagree, and I am distressed.................... O
Disagree, and I am very distressed............ O

21. I am treated unfairly at work.

Disagree.. O
Agree, but I am not at all distressed........... O
Agree, and I am somewhat distressed....... O
Agree, and I am distressed........................ O
Agree, and I am very distressed................. O

22. My job promotion prospects are poor.

Disagree.. O
Agree, but I am not at all distressed........... O
Agree, and I am somewhat distressed....... O
Agree, and I am distressed........................ O
Agree, and I am very distressed................. O

23. I have experienced or I expect to experience an undesirable change in my work situation.

Disagree.. O
Agree, but I am not at all distressed........... O
Agree, and I am somewhat distressed....... O
Agree, and I am distressed........................ O
Agree, and I am very distressed................. O

24. My employment security is poor.

- Disagree.. O
- Agree, but I am not at all distressed........... O
- Agree, and I am somewhat distressed....... O
- Agree, and I am distressed......................... O
- Agree, and I am very distressed................. O

25. My current occupational position adequately reflects my education and training.

- Agree.. O
- Disagree, but I am not at all distressed...... O
- Disagree, and I am somewhat distressed... O
- Disagree, and I am distressed.................... O
- Disagree, and I am very distressed............ O

26. Considering all my efforts and achievements, I receive the respect and prestige I deserve at work.

- Agree.. O
- Disagree, but I am not at all distressed...... O
- Disagree, and I am somewhat distressed... O
- Disagree, and I am distressed.................... O
- Disagree, and I am very distressed............ O

27. Considering all my efforts and achievements, my job promotion prospects are adequate.

- Disagree, but I am not at all distressed...... O
- Disagree, and I am somewhat distressed... O
- Disagree, and I am distressed.................... O
- Disagree, and I am very distressed............ O

28. Considering all my efforts and achievements, my salary / income is adequate.

- Agree.. O
- Disagree, but I am not at all distressed...... O
- Disagree, and I am somewhat distressed... O
- Disagree, and I am distressed.................... O
- Disagree, and I am very distressed............ O

THANK-YOU FOR TAKING THE TIME TO COMPLETE THE SURVEY

PLEASE POST THIS SURVEY AND THE CONSENT FORMS BACK TO US IN THE REPLY PAID ENVELOPE PROVIDED

Appendix 1D: *partnering*Healthy@Work survey 2013

ID NUMBER: ________________

partnering HEALTHY@WORK QUESTIONNAIRE

This questionnaire asks for some general information about you, as well as some information about your physical and emotional health, your diet and physical activity, and your employment.

Instructions: Please read carefully

Please answer all questions to the best of your ability (leave blank if unknown).

Your answers will be completely confidential.

Indicate your response by filling in the circle next to the most appropriate answer.

Example:

Shade circles like this ●

Not like this ⊠ or ✓

Cross out mistakes like this

or by writing clearly using the boxes where provided.

Example: | |4|/| |3|/|2|0|1|3|

Please use BLOCK LETTERS where required.

Cross out any mistakes and write the correct answer just below the relevant boxes.

Please use a black or blue pen if possible.

2

SECTION A

This section asks you some general questions about yourself.

1. **Today's date:** ☐☐ / ☐☐ / ☐☐ (dd/mm/yy)

2. **Your date of birth:** ☐☐ / ☐☐ / ☐☐ (dd/mm/yy)

3. **What is your sex?** O Male O Female

4. **What is your current marital status?**
   - O Single
   - O Married
   - O De facto
   - O Separated/Divorced
   - O Widowed

5. **What is the <u>highest</u> level of education you have completed? (Select only one)**
   - O Primary school
   - O Year 7, 8 or 9 or equivalent
   - O Year 10 or equivalent
   - O Year 12 or equivalent
   - O Trade/apprenticeship *(e.g. hairdresser, chef)*
   - O Certificate/diploma *(e.g. child care, technician)*
   - O University degree
   - O Higher university degree *(e.g. Grad Dip, Masters, PhD)*

6. **What is the composition of your household?**
   - O Couple family with children
   - O Couple family without children
   - O One parent family
   - O Group household
   - O Lone household

7. a) **What would you say is the single most important thing you personally could do to improve your health or reduce your risk of getting sick? Write on the line below.**

   ____

   b) **For this change, which one applies to you now?**
   - O I am not thinking of making this change
   - O I am thinking about making this change, but not in the next fortnight
   - O I am thinking about making this change in the next fortnight or so
   - O I am trying to make this change at the moment

3

SECTION B

These questions are about your diet and smoking tobacco.

1. **How many serves of vegetables (excluding potatoes) do you usually eat each day?** ***(One serve = ½ cup cooked vegetables or 1 cup of salad vegetables)***

O 1 serve or less O 2 serves O 3 serves O 4 serves O 5 serves O 6 or more serves

O Don't eat vegetables

2. **How many serves of fruit do you usually eat each day?** ***(One serve = 1 medium piece of fruit or 1 cup of diced pieces)***

O 1 serve or less O 2 serves O 3 serves O 4 or more serves

O Don't eat fruit

3. **How many times do you eat red meat in an average week, including sausages, luncheon meat, salami, meat pies, hamburger or bacon (but not including fish or poultry)?**

O Ten or more times per week
O Five to nine times a week
O Three to four times a week
O Once or twice a week
O Less than once a week
O Never

4. **How often do you eat fish or seafood in an average week?**

O Six or more times a week
O Three to five times a week
O Once or twice a week
O Less than once a week
O I never eat fish for medical reasons
O I never eat fish for religious or ethical reasons
O I never eat fish for other reasons *(please specify)*______________________

5. **How many times per week would you usually eat hot takeaway meals? (e.g. pizza, burgers, fried or roast chicken, Chinese/Indian/Thai takeaway)**

O I don't eat takeaway
O 1 meal or less per month
O 1 meal per week
O 2-3 meals per week
O 4-5 meals per week
O 6-7 or more meals per week

6. What type of milk do you usually consume?

O Condensed
O Full cream (normal milk)
O Almost equal amounts of full cream and reduced fat
O Reduced fat
O Skim
O None
O Other *(please specify)*____________________________

7. How often do you add salt to your food after it is cooked?

O Never
O Rarely
O Sometimes
O Almost always
O Always

8. How many days per week do you usually have something to eat for breakfast?

O Rarely or never
O 1-2 days
O 3-4 days
O 5 or more days
O Don't know/varies/depends

9. How often do you have a drink containing alcohol?

O Never **(skip to Q.12)**
O Monthly or less
O 2 to 4 times a month
O 2 to 3 times a week
O 4 or more times a week

10. How many standard drinks do you have on a typical day when you are drinking? ***(Please refer to the Standard Drink Guide on the next page for examples of standard drinks).***

O 1 or 2
O 3 or 4
O 5 or 6
O 7 to 9
O 10 or more

11. How often do you have 5 or more standard drinks on one occasion?

O Never
O Less than monthly
O Monthly
O Weekly
O Daily or almost daily

Standard Drink Guide

Source: Australian Government Department of Health and Ageing

12. Over your lifetime, have you smoked <u>at least 100 cigarettes</u> or a similar amount of tobacco?

O Yes **(Answer Q.13)** O No **(Skip to Section C)**

13. Have you ever been a <u>daily</u> smoker?

O Yes O No **(Skip to Section C)**

a) At what age did you start smoking <u>daily</u>?

☐☐ years

b) How often do you <u>now</u> smoke cigarettes, cigars, pipes or any other tobacco products?

O Daily **(Skip to Section C)**
O At least weekly (but not daily)
O Less often than weekly
O Not at all

c) At what age did you finally <u>stop</u> smoking daily?

☐☐ years

SECTION C

These questions are about your current physical activities.

The following questions will ask you about the time you spent being physically active in the last 7 days. Please think about the activities you do at work, as a part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Please answer each question even if you do not consider yourself to be an active person.

Think about all the **vigorous** and **moderate** activities that you did in the **last 7 days**.

- **Vigorous** physical activities refer to activities that take **hard** physical effort and make you breathe much harder than normal.
- **Moderate** activities refer to activities that take moderate physical effort and make you breathe **somewhat** harder than normal.

PART 1: WORK-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home.

Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. We ask about these in Part 3.

1. Do you currently have a job or do any unpaid work outside your home?

O Yes
O No → ***Skip to PART 2: TRANSPORTATION***

The next questions are about all the physical activity you did in the last 7 days as part of your paid or unpaid work. This does not include travelling to and from work.

2. During the **last 7 days**, on how many days did you do vigorous physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**? Think about only those physical activities that you did for **at least 10 minutes** at a time.

_____ **days per week**

O No vigorous job-related physical activity → ***Skip to question 4***

3. How much time did you usually spend on one of those days doing vigorous physical activities as part of your work?

_____ **hours per day**
_____ **minutes per day**

4. Again, think about only those physical activities that you did for **at least 10 minutes** at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads as part of your work? *Please DO NOT include walking.*

   _____ **days per week**

   O No moderate job-related physical activity → ***Skip to question 6***

5. How much time did you **usually** spend on one of those days doing **moderate** physical activities as part of your work?

   _____ **hours per day**
   _____ **minutes per day**

6. During the last 7 days, on how many days did you walk for **at least 10 minutes** at a time as part of your work? Please do not count any walking you did to travel to or from work.

   _____ **days per week**

   O No job-related walking → ***Skip to PART 2: TRANSPORTATION***

7. How much time did you usually spend on **one** of those days **walking** as part of your work?

   _____ **hours per day**
   _____ **minutes per day**

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you travelled from place to place, including to places like work, stores, movies, and so on.

8. During the last 7 days, on how many days did you travel **in a motor vehicle** like a train, bus, car, or tram?

   _____ **days per week**

   O No travelling in a motor vehicle → ***Skip to question 10***

9. How much time did you **usually** spend in a motor vehicle on **one** of those days?

   _____ **hours per day**
   _____ **minutes per day**

Now think only about the <u>cycling</u> and <u>walking</u> you might have done to travel to and from work, to do errands, or to go from place to place.

10. During **the last 7 days**, on how many days did you **cycle** for **at least 10 minutes** at a time to go from place to place?

   _____ **days per week**

   O No bicycling from place to place → ***Skip to question 12***

11. How much time did you usually spend on **one** of those days **cycling** from place to place?

_____ **hours per day**
_____ **minutes per day**

12. During the last 7 days, on how many days did you **walk** for **at least 10 minutes** at a time to go from place to place?

_____ **days per week**

O No walking from place to place → ***Skip to PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY***

13. How much time did you usually spend on **one** of those days **walking** from place to place?

_____ **hours per day**
_____ **minutes per day**

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the last 7 days in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

YARD WORK:

14. Think about only those physical activities that you did for at **least 10 minutes** at a time. During **the last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, chopping wood, or digging in the garden or yard?

_____ **days per week**

O No vigorous activity in garden or yard → ***Skip to question 16***

15. How much time did you usually spend on **one** of those days doing **vigorous** physical activities **in the garden or yard?**

_____ **hours per day**
_____ **minutes per day**

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking **in the garden or yard**?

_____ **days per week**

O No moderate activity in garden or yard → ***Skip to question 18***

17. How much time did you usually spend on one of those days doing **moderate** physical activities **in the garden or yard?**

_____ **hours per day**
_____ **minutes per day**

HOUSEWORK

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside your home**?

_____ **days per week**

O No moderate activity inside home → ***Skip to PART 4: RECREATION, SPORT AND LEISURE-TIME PHYSICAL ACTIVITY***

19. How much time did you usually spend on one of those days doing **moderate** physical activities **inside your home?**

_____ **hours per day**
_____ **minutes per day**

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the last 7 days solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?

_____ **days per week**

O No walking in leisure time → ***Skip to question 22***

21. How much time did you usually spend on one of those days **walking** in your leisure time?

_____ **hours per day**
_____ **minutes per day**

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time**?

_____ **days per week**

O No vigorous activity in leisure time → ***Skip to question 24***

23. How much time did you usually spend on one of those days doing **vigorous** physical activities in your leisure time?

_____ **hours per day**
_____ **minutes per day**

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis **in your leisure time**?

_____ **days per week**

O No moderate activity in leisure time → ***Skip to PART 5: TIME SPENT SITTING***

25. How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time?

_____ **hours per day**
_____ **minutes per day**

PART 5: TIME SPENT SITTING

These last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television.
Do not include any time spent sitting in a motor vehicle that you have already told us about.

26. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekday**?

_____ **hours per day**
_____ **minutes per day**

27. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekend day**?

_____ **hours per day**
_____ **minutes per day**

Now we would like to know about the time you spend at your workplace **on a typical day**.

28. Please estimate the time that you spend **at your workplace** on a typical day.

_____ **hours per day**
_____ **minutes per day**

29. Please estimate the time that you spend **sitting at your workplace**, including during meal and snack breaks, on a typical day.

_____ **hours per day**
_____ **minutes per day**

30. How many times on a typical day, while at your workplace, do you **interrupt your sitting**? For example, by standing up, walking somewhere, or getting a coffee.

_____ **times**

11

SECTION D

This section is about your health.

1. **How tall are you without shoes?** ☐☐☐ cm **OR** ☐☐ ft ☐☐ in

2. **(Females only) Are you currently pregnant?** O Yes **(Skip to Q.5)** O No

3. **How much do you weigh?** ☐☐☐ kg **OR** ☐☐ st ☐☐ lb

4. **How much would you like to weigh now? (Select only one)**

   O Happy as I am
   O 1 – 5 kg more
   O Over 5 kg more
   O 1 – 5 kg less
   O 6 – 10 kg less
   O Over 10 kg less

The following questions ask for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities.

5. **In general, would you say your health is:**

   O Excellent O Very good O Good O Fair O Poor

6. **The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?**

	YES, limited a lot	YES, limited a little	NO, not limited at all
a) Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	O	O	O
b) Climbing several flights of stairs	O	O	O

7. **During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a) Accomplished less than you would like	O	O	O	O	O
b) Were limited in the kind of work or other activities	O	O	O	O	O

8. During <u>the past 4 weeks</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of any emotional problems</u> (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a) Accomplished less than you would like.	O	O	O	O	O
b) Did work or other activities less carefully than usual	O	O	O	O	O

9. During the <u>past 4 weeks</u>, how much did <u>pain</u> interfere with your normal work (including both work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
O	O	O	O	O

10. These questions are about how you feel and how things have been with you <u>during the past 4 weeks</u>. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the **<u>past 4 weeks:</u>**	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a) Have you felt calm and peaceful?	O	O	O	O	O
b) Did you have a lot of energy?	O	O	O	O	O
c) Have you felt downhearted and depressed?	O	O	O	O	O

11. During the <u>past 4 weeks</u>, how much of the time has your <u>physical health or emotional problems</u> interfered with your social activities (like visiting with friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
O	O	O	O	O

12. Do you currently have any of the following conditions?

		Yes	No
a)	Arthritis or rheumatism	O	O
b)	Chronic back pain	O	O
c)	Migraine headaches	O	O
d)	Other frequent or severe headaches	O	O
e)	Any other chronic pain	O	O
f)	High blood pressure or hypertension	O	O
g)	Congestive heart failure	O	O
h)	Coronary heart disease	O	O
i)	High blood cholesterol	O	O
j)	An ulcer in your stomach or intestine	O	O
k)	Irritable bowel disorder	O	O
l)	Chronic heart burn or gastroesophageal reflux disease	O	O
m)	Asthma	O	O
n)	Chronic bronchitis or emphysema	O	O
o)	Seasonal allergies or hay fever	O	O
p)	Chronic Obstructive Pulmonary Disease	O	O
q)	Urinary or bladder problems	O	O
r)	Diabetes	O	O
s)	Obesity	O	O
t)	Chronic sleeping problems	O	O
u)	Chronic fatigue or low energy	O	O
v)	Osteoporosis	O	O
w)	Skin cancer	O	O
x)	Any other type of cancer	O	O

13. How many times in the last 12 months have you been admitted overnight or longer in any hospital for any reason? ☐☐ times

a) (Females only) How many of these times were for pregnancy or child birth? ☐☐ times

14. In the past 12 months, how many nights in total did you stay in hospital? ☐☐ nights

a) (Females only) How many of these nights were due to pregnancy or child birth? ☐☐ nights

14

The following ten questions ask about how you have been feeling in the last four weeks. For each question, fill in the circle under the option that best describes the amount of time you felt that way.

		None of the time	A little of the time	Some of the time	Most of the time	All of the time
15.	In the past 4 weeks about how often did you feel tired out for no good reason?	○	○	○	○	○
16.	In the past 4 weeks about how often did you feel nervous?	○	○	○	○	○
17.	In the past 4 weeks about how often did you feel so nervous that nothing could calm you down?	○	○	○	○	○
18.	In the past 4 weeks about how often did you feel hopeless?	○	○	○	○	○
19.	In the past 4 weeks about how often did you feel restless or fidgety?	○	○	○	○	○
20.	In the past 4 weeks about how often did you feel so restless you could not sit still?	○	○	○	○	○
21.	In the past 4 weeks about how often did you feel depressed?	○	○	○	○	○
22.	In the past 4 weeks about how often did you feel that everything was an effort?	○	○	○	○	○
23.	In the past 4 weeks about how often did you feel so sad that nothing could cheer you up?	○	○	○	○	○
24.	In the past 4 weeks about how often did you feel worthless?	○	○	○	○	○

SECTION E

These questions are about your employment in the Tasmanian State Service.

1. **Do you have <u>more than one</u> paid position in the Tasmanian State Service?**
   - O No **(Skip to Q. 3)**
   - O Yes

2. **Please specify what your consider to be your main job** Agency__________________ Job Title __________________

Please answer all questions in Section E in relation to your main job in the Tasmanian State Service

3. **On which days of the week do you usually work?**
   - O Five days a week Monday to Friday
   - O Days vary from week to week
   - O Other – please specify days below
     - O Monday O Tuesday O Wednesday O Thursday O Friday O Saturday O Sunday

4. **Which of the following options best describe your current work schedule?**
   Please choose all that apply
   - O A regular daytime schedule
   - O A regular night shift
   - O Split shift (two distinct periods per day)
   - O Irregular schedule
   - O A regular evening shift
   - O A rotating shift (changes from days to evenings to nights)
   - O On call
   - O Other – please specify ____________________

5. **How many hours per week do you usually work? Include any paid or unpaid overtime.**
   This includes any work done at the workplace and at home. Don't include time 'on-call'.

   ☐☐ hours per week

6. **If you could choose the number of hours you work each week, *and taking into account how that would affect your income*, would you prefer to work:**
   - O Fewer hours than you do now?
   - O About the same hours as you do now?
   - O More hours than you do now?

7. **How many days in the last 4 weeks have you stayed away from your work for more than half the day because of health problems?**

   ☐☐ days

8. **How many days in the last 4 weeks did you go to work while suffering from health problems?**

   ☐☐ days

9. **On these days when you went to work suffering from health problems, what percentage of your time were you as productive as usual?**
   For example, if you were exactly as productive as usual please mark '100 %'.

   Please indicate the percentage with a vertical line on the scale below.

   0% 20% 40% 60% 80% 100%

The following items refer to your main job in the Tasmanian State Service. For each of the following statements, please indicate to what degree it reflects your situation.
Thank you for answering all statements!

10. I have constant time pressure due to a heavy work load.
- Disagree.. O
- Agree, but I am not at all distressed........... O
- Agree, and I am somewhat distressed....... O
- Agree, and I am distressed......................... O
- Agree, and I am very distressed................. O

11. I have many interruptions and disturbances while performing my job.
- Disagree.. O
- Agree, but I am not at all distressed........... O
- Agree, and I am somewhat distressed....... O
- Agree, and I am distressed......................... O
- Agree, and I am very distressed................. O

12. I have a lot of responsibility in my job.
- Disagree.. O
- Agree, but I am not at all distressed........... O
- Agree, and I am somewhat distressed....... O
- Agree, and I am distressed......................... O
- Agree, and I am very distressed................. O

13. I am often pressured to work overtime.
- Disagree.. O
- Agree, but I am not at all distressed........... O
- Agree, and I am somewhat distressed....... O
- Agree, and I am distressed......................... O
- Agree, and I am very distressed................. O

14. My job is physically demanding.
- Disagree.. O
- Agree, but I am not at all distressed........... O
- Agree, and I am somewhat distressed....... O
- Agree, and I am distressed......................... O
- Agree, and I am very distressed................. O

15. Over the past few years, my job has become more and more demanding.

Disagree..	O
Agree, but I am not at all distressed...........	O
Agree, and I am somewhat distressed.......	O
Agree, and I am distressed..........................	O
Agree, and I am very distressed.................	O

16. I receive the respect I deserve from my superiors.

Not applicable (no superiors).......................	O
Agree..	O
Disagree, but I am not at all distressed......	O
Disagree, and I am somewhat distressed...	O
Disagree, and I am distressed.....................	O
Disagree, and I am very distressed............	O

17. I receive the respect I deserve from my colleagues.

Not applicable (no colleagues)....................	O
Agree..	O
Disagree, but I am not at all distressed......	O
Disagree, and I am somewhat distressed...	O
Disagree, and I am distressed.....................	O
Disagree, and I am very distressed............	O

18. I experience adequate support in difficult situations.

Agree..	O
Disagree, but I am not at all distressed......	O
Disagree, and I am somewhat distressed...	O
Disagree, and I am distressed.....................	O
Disagree, and I am very distressed............	O

19. I am treated unfairly at work.

Disagree..	O
Agree, but I am not at all distressed...........	O
Agree, and I am somewhat distressed.......	O
Agree, and I am distressed..........................	O
Agree, and I am very distressed.................	O

20. My job promotion prospects are poor.

Disagree..	O
Agree, but I am not at all distressed...........	O
Agree, and I am somewhat distressed.......	O
Agree, and I am distressed..........................	O
Agree, and I am very distressed.................	O

21. I have experienced or I expect to experience an undesirable change in my work situation.

Disagree..	O
Agree, but I am not at all distressed...........	O
Agree, and I am somewhat distressed.......	O
Agree, and I am distressed..........................	O
Agree, and I am very distressed.................	O

18

22. My employment security is poor.

Disagree..	O
Agree, but I am not at all distressed...........	O
Agree, and I am somewhat distressed.......	O
Agree, and I am distressed.........................	O
Agree, and I am very distressed.................	O

23. My current occupational position adequately reflects my education and training.

Agree..	O
Disagree, but I am not at all distressed......	O
Disagree, and I am somewhat distressed...	O
Disagree, and I am distressed....................	O
Disagree, and I am very distressed............	O

24. Considering all my efforts and achievements, I receive the respect and prestige I deserve at work.

Agree..	O
Disagree, but I am not at all distressed......	O
Disagree, and I am somewhat distressed...	O
Disagree, and I am distressed....................	O
Disagree, and I am very distressed............	O

25. Considering all my efforts and achievements, my job promotion prospects are adequate.

Agree..	O
Disagree, but I am not at all distressed......	O
Disagree, and I am somewhat distressed...	O
Disagree, and I am distressed....................	O
Disagree, and I am very distressed............	O

26. Considering all my efforts and achievements, my salary / income is adequate.

Agree..	O
Disagree, but I am not at all distressed......	O
Disagree, and I am somewhat distressed...	O
Disagree, and I am distressed....................	O
Disagree, and I am very distressed............	O

How far do you agree or disagree with the following statements?

		Strongly agree	Agree	Disagree	Strongly Disagree	Don't know
27.	I feel proud when I tell others I am part of my organisation	O	O	O	O	O
28.	I would recommend my organisation a great place to work	O	O	O	O	O
29.	I feel a strong personal attachment to my organisation	O	O	O	O	O
30.	My organisation inspires me to do the best in my job	O	O	O	O	O
31.	My organisation motivates me to help it achieve its objectives	O	O	O	O	O

The following items are about health activities in <u>your workplace</u> for your main job in the Tasmanian State Service.

32. Please indicate the amenities/supports that are available. Choose all that apply.

O Space to hold activities

O Equipment storage areas

O Lunch / break room

O Onsite gymnasium / fitness centre

O Bicycle racks/storage

O Healthy vending machine options

O Workplace Wellness Health Champions

O Shower and change facilities

O Fruit baskets provided

O Outdoor exercise areas for employees to use

O Stairs / stair wells that can be used for exercise

O Healthy food options (e.g work meetings, on-site)

O Drinking water

O Flexible work arrangements

O Bulletin boards, newsletters, emails or websites where health information is provided

O Other (please specify) ______________________________

20

33. Please indicate which workplace health and wellbeing activities were available in the past 3 years. If 'yes', please indicate the number of times you participated.

Type of health and wellbeing activities available	Available in the past 3 years: No	Available in the past 3 years: Yes	Number of times you participated in the past 3 years — If yes, please enter a number
a) **Education** e.g. Health information seminars or workshops	○	○	☐☐☐
b) **Health assessments** e.g. Health checks (BUPA/MBF health lounges), regular health assessments, regular fitness assessments, pre-employment health screening	○	○	☐☐☐
c) **Physical activity** e.g. Global Corporate Challenge, Hydra-Walk, organisation sport team, sport or activity days, exercise or physical activity sessions (e.g. yoga, fit-ball, boot camp), active transport (e.g. TravelSmart Workplace Program, cycle to work or walk to work)	○	○	☐☐☐
d) **Smoking** e.g Smoking cessation programs (e.g. nicotine replacement, counselling)	○	○	☐☐☐
e) **Mental health and wellbeing** e.g. Employee Assistance Programs, stress-management program or strategies, allocated stretching or relaxing times, massage, personal development opportunities for life skills, training or activities for mental health and wellbeing (e.g. Mental Health First Aid, Mindfulness, Flourishing People Happiness Training, *beyondblue*)	○	○	☐☐☐
f) **Interrupted sitting** e.g. Exertime, Project Pause, standing work station	○	○	☐☐☐
g) **'Walk and talk' or active meetings**	○	○	☐☐☐
h) **Flu vaccination**	○	○	☐☐☐
i) **Injury prevention/rehabilitation**	○	○	☐☐☐
j) **Subsidised membership to off-site facilities or programs**	○	○	☐☐☐
k) **Regular health and wellbeing activities facilitated by the organization** e.g. walking/cycling groups	○	○	☐☐☐
l) **Other** (Please specify)________________________	○	○	☐☐☐

If you did not participate in any of the above activities, skip to question 35.

34. Did the workplace health and wellbeing activities listed in question 33 -

	Yes	No	Not sure
a) Help you to -			
Improve your health	O	O	O
Be more physically active	O	O	O
Quit smoking	O	O	O
Eat more healthily	O	O	O
Drink less alcohol	O	O	O
Lose weight	O	O	O
Reduce stress	O	O	O
Improve your performance at work	O	O	O
b) Give you the opportunity to -			
Be physically active	O	O	O
Eat more healthily	O	O	O
c) Make you motivated to -			
Be physically active	O	O	O
Quit smoking	O	O	O
Eat more healthily	O	O	O
Drink less alcohol	O	O	O
d) Make it more affordable to -			
Be physically active	O	O	O
Eat more healthily	O	O	O
e) Change the way you feel about -			
Your health	O	O	O
Being physically active	O	O	O
Quitting smoking	O	O	O
Eating more healthily	O	O	O
Drinking alcohol	O	O	O
Your job	O	O	O

35. a) Please indicate how you feel about the following statements, even if you *did not* take part in any of the activities or programs listed in question 33.

	Strongly agree	Agree	Disagree	Strongly disagree
I was consulted in the design of the activities	O	O	O	O
I have the support of my managers to take part	O	O	O	O
My organisation places a high priority on these activities	O	O	O	O
My co-workers were interested in taking part	O	O	O	O
The activities offered can improve my health and wellbeing	O	O	O	O

35. b) In general, the activities were:

	Strongly agree	Agree	Disagree	Strongly disagree
Well publicised	O	O	O	O
Interesting to me	O	O	O	O
Relevant to my needs	O	O	O	O
Convenient to participate in	O	O	O	O
Helpful	O	O	O	O

36. Has anything prevented you from participating in the health and wellbeing activities offered through your workplace?

O No O Yes

If yes, what?____

37. Please indicate how you feel about the following statements even if you did not participate in any of the activities or programs listed in question 33.

	Strongly agree	Agree	Disagree	Strongly disagree
I am already doing enough outside of work to maintain my health and wellbeing	O	O	O	O
Problems with my health prevented me from participating	O	O	O	O
My health is not the responsibility of my employer	O	O	O	O
I have trouble fitting these activities around my family/other commitments	O	O	O	O
There were no activities or programs available to me	O	O	O	O
I am too busy at work to have time to participate	O	O	O	O

38. In the past 3 years, did you spend any of your own money to take part in any of the workplace activities listed in question 33?

O No O Yes ——→ Total amount you spent in dollars $☐☐☐☐

THANK YOU FOR TAKING THE TIME TO COMPLETE THE SURVEY

PLEASE RETURN THE SURVEY IN THE REPLY PAID ENVELOPE PROVIDED

2 Chapter two: The relationship between return on investment and quality of study methodology in workplace health promotion programs: a systematic review

2.1 Preface

The preceding Introduction Chapter identified a role for economic evaluations in workplace health promotion (WHP). Economic evaluations can be conducted in order to measure the financial impact of health-promoting initiatives in the workplace to provide information for evidence-based decisions. For example, cost benefit analysis can assess allocation efficiency and determine whether or not the intervention is worthwhile.[1] The importance of methodological quality and current critical appraisal methods of economic evaluations were also introduced in Chapter 1. Economic analytical techniques in WHP research are variable in methodological quality.[2-4] As a result, decision makers must use caution in the interpretation of published WHP economic outcomes.

This chapter provides a definitive systematic review of the economic evidence in WHP under methodological scrutiny. This chapter has been published in the *American Journal of Health Promotion* (Appendix 2A).

Impact factor: 2.37 (as of June 2015).

> **Baxter S**, Sanderson K, Venn AJ, Blizzard CL, Palmer AJ. "The Relationship between Return on Investment and Quality of Study Methodology in Workplace Health Promotion Programs" *American Journal of Health Promotion* July 2014; 28(6): 347-363.

Additional notes (grey boxes) were added for this thesis and were not part of the original publication.

2.2 Introduction

Workplace health promotion (WHP) encompasses health promoting and illness prevention activities that are available in the workplace. Activities can range from single, one-off interventions (e.g. influenza vaccination), to multi-component, multi-level health interventions. Economic evaluations of WHP are undertaken to assess outcomes (benefits), either potential or realised, for a given cost of program implementation (costs). Rigorous estimates of financial impact serve to better engage stakeholders and encourage sustainability of investment in workplace health initiatives. Despite this need, economic evaluations of WHP are often of poor methodological quality. This was highlighted in a most recent review[4] which concluded no positive, negative or neutral return on investment (ROI) could be estimated due to a lack of high methodological quality economic evaluations found. This finding echoes a cautionary past from arguably the earliest review in the field[2] which exposed economic evaluations as subject to both study design and methodological quality inconsistencies. Recent evidence identified that study design can impact reported financial outcomes,[5] concluding randomised control trials (RCTs) were more likely to indicate a negative return.

Our study investigated methodological quality. We defined quality as the quality of economic evidence of studies (methodological quality), and examined the impact such quality has on ROI. This was accomplished through a systematic review of comparative health economic evaluations in WHP (single-target or multicomponent interventions), the assessment of methodological quality of the evidence and examination of the relationship between quality, key study characteristics and ROI.

Well-cited systematic reviews have established a strong positive message with consistent evidence of a favourable ROI from workplace health interventions.[6-10] This consistency could be partly due to the duplication of empirical studies seen within them. For example, four of these reviews[6,7,9,10] span a 13 year period (1999-2012) and represent 89 evaluation studies, of which 75 (84%) were reviewed more than once, 36 (40%) reviewed in three or more and 19 (21%) in all four. In addition, the included studies predominantly predated year 2000. Two recent reviews[4,11] excluded studies pre-dating year 2000, and both adopted a more careful consideration of economic impact in light of methodological flaws. These reviews also excluded studies conducted outside the United States (US) which may lack applicability for stakeholders in countries like Australia and the United Kingdom (UK) where small to medium enterprises (SMEs) predominate, and employee healthcare provisions are not incumbent on employers due to a national healthcare system. Thus, US-reviews include costs borne outside an employer perspective in such nations. Furthermore, these reviews did not investigate the effect poor economic quality may have on financial outcome.

Contemporary health economic theory offers better standardised methods for evaluating resource use and costs, with guidelines, recommendations and methodological quality checklists to improve standards.[12-22] Weaknesses in methodology and reporting of economic evaluations of WHP undermine their plausibility. Our aim was to examine the ROI of WHP through a methodological quality lens. The main hypothesis was that higher methodological quality economic evaluations demonstrate smaller financial returns.

2.3 Methods

We performed a review following Campbell and Cochrane Economics Methods Group (CCEMG) guidelines to incorporating economic evidence in reviews,[17,18] the National Institute of Health and Clinical Excellence (NICE) guidelines manual,[19,20] and the Centre for Reviews and Dissemination (CRD) guidance for undertaking reviews in healthcare.[15] The guidance from these sources formed the basis of our search strategy (the use of economic search filters) (Table 2.1), our process of incorporating economic evidence through extended economic database searches (in addition to biomedical databases), our use of specific health economic evaluation inclusion criteria (only accepting studies that reported both costs and cost offsets against a comparison), our choice of methodological quality checklist and the structure of this report.

Table 2.1 Search strategy for National Health Service Economic Evaluation Database (NHS EED), Health Technology Assessment (HTA) Database and the Database of Abstracts of Reviews of Effects (DARE)

Long Search[a]	#1 AND #2 AND #3 NOT #4
#1 Economic filters (outcome)	"economic evaluation" OR cost OR effectiveness OR “return on investment” OR ROI OR "cost effectiveness" OR "cost benefit” OR “cost analysis” OR "cost utility" OR CUA OR CBA OR CEA OR "health economic*" OR economic* OR “direct cost” OR “indirect cost” OR “intangible cost” OR “health care cost” OR productivity OR claim OR turnover OR recruitment OR “sick leave” OR “illness days” OR absenteeism OR presenteeism in Title, Abstract or Keywords
#2 Participant	*workplace OR worksite OR worker* OR employee* OR “work place” OR employer OR organisat* OR organizat* OR employer OR business OR staff OR occupation* in Title, Abstract or Keywords*
#3 Intervention	*“health promotion” OR “prevention” OR health OR wellbeing OR wellness OR smoking OR nutrition* OR alcohol OR “psychological distress” OR physical activity OR exercise OR stress OR dental OR “health screening” OR BMI OR BP OR lipids OR flu vaccination OR counselling OR substance abuse OR HRA OR “weight management” OR obesity OR Cholesterol OR sleep OR “disease management” OR “disease risk” OR prevent* OR promot* OR “chronic disease” in Title, Abstract or Keywords*

#4 Excluding	*NOT "back pain" OR injur* in Title, Abstract or Keywords*
MESH Search[b]	(("Costs and Cost Analysis" explode all trees [Mesh] OR "Cost-Benefit Analysis" explode all trees [Mesh] OR "Cost of Illness" explode all trees [Mesh] OR "Cost Savings" explode all trees [Mesh] OR "Employer Health Costs" explode all trees [Mesh]) AND "Health Promotion" explode all trees [Mesh])

NHS EED indicates National Health Service Economic Evaluation Database; HTA: Health Technology Assessment Database; DARE: Database of Abstracts of Reviews of Effects.

aLong search performed on 15 November, 2011, yielded NHS EED (504), HTA (26), and DARE (107) studies

bMESH search performed on 7 December, 2011, yielded NHS EED (116), HTA (7), and DARE (13) studies

2.3.1 Data sources

A comprehensive systematic search of the literature was performed. Five economic databases — NHS Economic Evaluation Database (NHS EED), Database of Abstracts of Reviews of Effects (DARE), Health Technology Database (HTA), Cost Effectiveness Analysis Registry (CEA Registry), and American Economic Association EconLit (EconLit) — were searched along with major health databases PubMed, Embase, Wiley Online Library and Scopus. In addition, a keyword search using Google Scholar, and hand searching of citations from relevant papers, previous reviews and health promotion journals were undertaken. Economic search filters alongside the biomedical PICO standard (which references the Participants, Interventions, Comparisons and Outcomes) and medical subject headings (MeSH) terms were used. An example of the search strategy can be seen in Table 2.1.

2.3.2 Study inclusion and exclusion criteria

Studies that conducted a full health economic evaluation of a workplace health intervention were included. The evaluation by definition required a "comparative analysis of alternative courses of action in terms of both their costs and consequences" p 9 [1] meaning both costs and benefits were reported against a comparator. We defined the target population of each intervention as consisting of all adult employees currently working for an organisation that had facilitated a workplace health program, irrespective of their health status. The interventions ranged from those with a single-target focus (e.g. smoking cessation) or multicomponent focus (programs offering 2 or more behaviour targets). The scope of interventions included smoking, nutrition, alcohol, depression, anxiety, physical activity, stress, dental health, health screening, health risk assessment (HRA), cardio-metabolic risk (body mass index, blood pressure, blood, lipids), influenza 'flu'-vaccination, counselling, and substance abuse. Interventions that focused on organisational changes or a change in workplace culture were included provided that the primary outcome was improvement in employee health. Our aim was to include a broad range of interventions, and both single and multicomponent workplace health programs to provide a comprehensive picture of the economic outcomes associated with the diversity of WHP programs on offer. No exclusions were made based on location, number of components or delivery mode provided they were offered by an employer to benefit the health of current staff. No restriction on year of publication was imposed up to and including publications before May 2012, when study selection was complete. Studies written in English or German were considered as authors SB and AP are bilingual in these languages.

Return to work studies, studies of workplace safety (ie: injury and rehabilitation programs, which were viewed as occupational health-related prevention not disease prevention) and studies of retiree populations were excluded.

2.3.2.1 Study selection

From the initial yield, studies were selected after review of title and abstract. Final decision of inclusion was made after review of the entire manuscript by authors SB and AP.

2.3.3 Data extraction methods

Data were extracted on study design (RCT, quasi-experimental [ie: a non-randomised comparison group], non-experimental [ie: pre-post only, a before/after comparison group] and modelled), sample size and program length, authorship (private company, research institutions or government), country of origin, publication year, study characteristics (organisation size, industry type, employee target group [healthy, at risk or disease management]), and program design (single or multicomponent). Intervention focus was grouped into 3 categories: SNAPS (smoking, nutrition, alcohol, physical activity and stress), vaccination and other (dental, cancer screening). When studies reported more than one intervention arm alongside a comparator, the economic evaluation for each was considered a separate study, effectively increasing the number of studies.

Economic study metrics such as perspective, design (retrospective, prospective), time horizon (currency, time value), discount rate, comparator type (control group design, pre-post, modelled), effect measure (incremental or cost comparison), costs reported (direct, indirect), the economic form (cost benefit analysis [CBA],cost effectiveness analysis [CEA], cost utility analysis [CUA]), the calculation method, and how outcomes were measured and valued were also recorded along with economic results (reported costs, benefits and ROI). Data extraction and quality assessment (see below) were performed by one author (SB) and a 20% sample was independently coded by another (AP). Any disagreements were resolved through discussion.

2.3.3.1 Methodological quality assessment

Studies were scored against the 36-item British Medical Journal Economic Evaluation Working Party (BMJ checklist),[15,23] a guideline of methodological and essential elements to improve clarity of economic evaluations. Items referred to the study question, selection of alternatives, form of evaluation, effectiveness data, measurement and valuation of benefit, costing, modelling, adjustments for timing of costs and benefits, uncertainty and presentation of results and were all considered within three headings: study design, data collection and analysis and interpretation (Table 2.2). Each of the 36 items were given equal weighting and the items performed or reported were summed and expressed as a percentage of the total number of items applicable to each study.[15] Studies were then placed into categories of methodological quality; high quality (>75%), moderate quality (50-75%) and low quality (<50%).

Table 2.2 36-item British Medical Journal Economic Evaluation Working Party (BMJ checklist)*

Study design

1. Was the research question stated?
2. Was the economic importance of the research question stated?
3. Was/were the viewpoint(s) of the analysis clearly stated and justified?
4. Was a rationale reported for the choice of the alternative programmes or interventions compared?
5. Were the alternatives being compared clearly described?
6. Was the form of economic evaluation stated?
7. Was the choice of form of economic evaluation justified in relation to the questions addressed?

Data collection

8. Was/were the source(s) of effectiveness estimates used stated?
9. Were details of the design and results of the effectiveness study given (if based on a single study)?
10. Were details of the methods of synthesis or meta-analysis of estimates given (if based on an overview of a number of effectiveness studies)?
11. Were the primary outcome measure(s) for the economic evaluation clearly stated?
12. Were the methods used to value health states and other benefits stated?
13. Were the details of the subjects from whom valuations were obtained given?
14. Were productivity changes (if included) reported separately?
15. Was the relevance of productivity changes to the study question discussed?
16. Were quantities of resources reported separately from their unit cost?
17. Were the methods for the estimation of quantities and unit costs described?
18. Were currency and price data recorded?
19. Were details of price adjustments for inflation or currency conversion given?
20. Were details of any model used given?
21. Was there a justification for the choice of model used and the key parameters on which it

was based?

Analysis and interpretation of results

22. Was time horizon of cost and benefits stated?
23. Was the discount rate stated?
24. Was the choice of rate justified?
25. Was an explanation given if cost or benefits were not discounted?
26. Were the details of statistical test(s) and confidence intervals given for stochastic data?
27. Was the approach to sensitivity analysis described?
28. Was the choice of variables for sensitivity analysis justified?
29. Were the ranges over which the parameters were varied stated?
30. Were relevant alternatives compared? (i.e. Were appropriate comparisons made when conducting the incremental analysis?)
31. Was an incremental analysis reported?
32. Were major outcomes presented in a disaggregated as well as aggregated form?
33. Was the answer to the study question given?
34. Did conclusions follow from the data reported?
35. Were conclusions accompanied by the appropriate caveats?
36. Were generalisability issues addressed?

***From *Systematic Reviews: CRD's guidance for undertaking reviews in health care, 3rd ed.* York, UK: Centre for Reviews and Dissemination; 2009:210-211. Available at: http://www.york.ac.uk/inst/crd/index_guidance.htm. Reproduced with permission from CRD; York, UK.**

2.3.3.2 Economic outcomes

The financial outcomes within each study were represented as an ROI ratio and were either extracted if an ROI was provided, or (re)calculated from reported costs and benefits of a program against a comparator. When an ROI was not reported, the costs and benefits, as measured and specific to the individual study findings for monetary value (currency), price year and discounting (if applied) were extracted and the ROI formula applied.

The formula used was ROI = (Net Benefits – Net Costs of program)/Costs of program.[24]

When ROI was reported, the method of ROI calculation was examined and the accepted formula was applied to the reported costs and benefits if the calculation method differed. Our chosen methodology provided a consistent comparison of financial return between studies, in addition to the ratio alleviating any costing differences arising from currency and time variances across studies. It should be noted that many employers use ROI=Benefits/Costs as the formula for Return on Investment. We compared our ROI findings against its comparative ROI (calculated from this commonly used alternative) to examine whether our ROI formula accounted for any major difference in the ROI's we report.

The effect measure was categorised as either incremental (the calculated difference in program costs and benefits between the intervention and the comparator groups) or cost comparison (when benefits were defined as cost savings[1] when pre-post analysis). Benefits included change in worker productivity, and employer health care costs.

Costs were extracted as reported, irrespective of discounting. Whether or not discounting was performed was addressed by the BMJ methodological checklist (item #23/24/25) and accounted for in the quality scoring. Studies that did not report discounting beyond a one year time horizon were penalised in score (studies ≤ 1 year time horizon received a NA [not applicable] for these items). Additionally, we did not attempt to discount long term costs; a) to avoid possible "double discounting" in cases where authors may have discounted but failed to report it; b) as often costs were not itemised over time; and c) applying a discount rate to both costs and benefits (i.e. both denominator and numerator) would not affect the ROI ratio.

2.3.3.3 Data analysis

Summary data on ROI are presented as weighted mean and standard deviation (SD) with 95% confidence intervals (CI). Because the interventions reviewed differed markedly in scope and reach, the ROI for each study was weighted by the number of employees targeted directly or indirectly by the intervention program. Mean ROIs were stratified by study characteristics (refer to 2.3.3 Data extraction methods). Results of unweighted analyses are reported for comparison. To determine if certain study characteristics predict higher ROI, linear regression methods were used against the ROI weighted by relative number of participants. All weighted data were transformed prior to analysis to remove skewness. Being represented as a ratio, the dollar value of the numerator and denominator of each ROI estimate did not require conversion to units of common purchasing power.

All statistical analyses were conducted using STATA© version 12 software package (Statacorp LP, Texas, USA).

2.3.3.4 Sensitivity analysis

Sensitivity analysis of quality scoring was performed using two additional methodological quality checklists, the Consensus Health Economic Criteria list (CHEC-List),[14] and the NICE study limitations checklist: economic evaluations (NICE checklist).[20] Comparisons of quality scores made by the three checklists were undertaken by assessment of differences in mean scores and by using correlation coefficients to summarise stability of ranking.

Appendix 2B Tables 2B.1 and 2B.2. In this Appendix you can find the CHEC-List and the NICE study limitations checklist. Tables can be found on pages 135 and 136.

2.4 Results

2.4.1 Study selection

The search concluded in May 2012 following an electronic search (conducted between 24 October and 8 December 2011) and hand-searching. The electronic search yielded 3,906 studies. Economic databases generated 1,295 studies (NHSEED (n=620), EconLit (n=518), DARE (n=120), HTA (n=33), and CEA Registry (n=4)), and health databases produced 2,611 studies (MEDLINE (n=79), Wiley (n=33), Scopus (n=1,338) and EMBASE (n=1,161)).

Appendix 2C Supplemental Table 2C.1. This table offers a breakdown of the long and MESH search for the studies yielded in the electronic search. This table is found on page 137.

After removal of duplicates (n=400), 2,695 papers were excluded following abstract and title screening. The majority (n=1,962) of excluded studies were not workplace health intervention studies. Ultimately 42 studies met the inclusion criteria. A further nine were excluded by authors SB and AP by consensus due to inadequate economic cost data, including lack of comparative analysis or reported program costs or cost offsets,[25-33] reducing the total to 33 studies. Additionally, 18 studies were sourced by hand-searching reference lists, for a total of 51 included studies (61 intervention arms) (Figure 2.1).

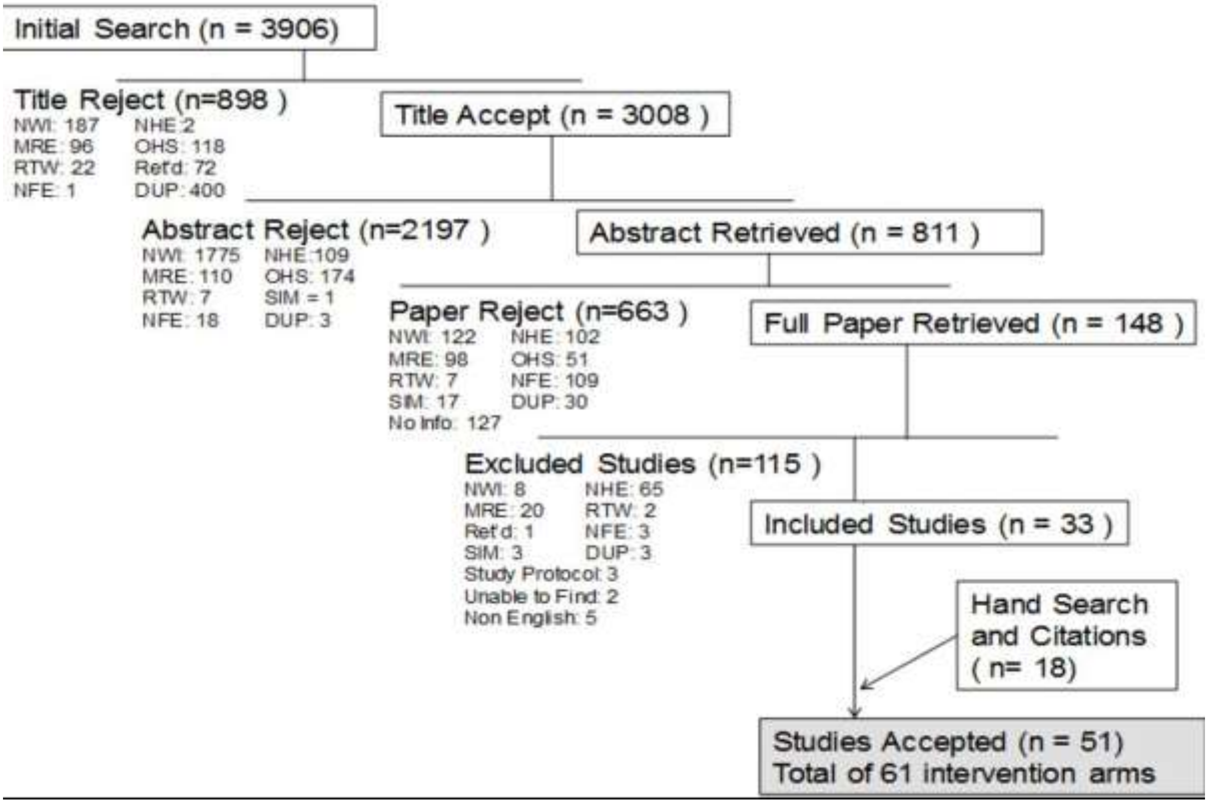

Figure 2.1 Flow diagram of study selection

NWI = Not a workplace health intervention; NHE = Not a single, empirical primary study reporting a health economic evaluation by offering a health economic component, showing evidence of cost analysis where cost of program and cost offsets are reported against a comparison; MRE = Papers that are meta-analyses, reviews, editorials, letters, or policy papers; OHS = Occupational health related injuries, accidents and prevention studies; RTW = Chronic and long term sick leave, return to work, injury and rehabilitation studies; Ret' d = Studies of non-employees, simulated participants or retirees; NFE = Not facilitated by the employer; DUP = Duplicate or previously accepted study; SIM = Studies solely modelled on simulated participants

2.4.2 Study characteristics

Characteristics of included studies are displayed in Table 2.3, listed by their methodological quality and categorised by intervention focus ie: traditional health promotion programs (SNAPS) and medical/dental programs (vaccination, dental, screening). A subset of studies (n=20) that reported direct measurement of claims and records are shown in Table 2.4.

Table 2.3 Study characteristics

Studies (N=51)	Year	Study Design	Origin	Duration *(years)*	Organisation Size	Industry	Participant *n*	Control *n*	Intervention	Currency	Time Value	ROI	BCR
CATEGORISED HIGH QUALITY (N=15); QUALITY SCORE >75%													
Traditional health promotion programs													
Groeneveld et al.[66]	2011	RCT	Netherlands	0.5	NS	Construction	293	280	Wt,Ind	EUR	2008	-0.24~	0.76
Proper et al.[68]	2004	RCT	Netherlands	0.75	PS	Local Gov	97	167	N,PA,Ind	EUR	NS	-0.71ψ	0.29
Meenan et al.[67]	2010	RCT	USA	2	Large	Hospitality	3346	3612	HRA,N,Wt,Ind	USD	2008	-0.74~	0.26
McEachan et al.[39]*	2011	RCT	UK	0.25	NS	Various	662	598	PA	GBP	NS	-4.30ψ	-3.30
Greene et al.[65]*	2009	Model	USA	0.5	Large	El-Gas-Oil-W	499	499ɸ	CM,Dx	USD	2007	3.42ψ	4.42
Naydeck et al.[78]	2008	Model	USA	4	Large+	Insurance	1892	1892ɸ	HRA,Sm,N,Wt,PA,MH, CM,Dx	USD	2005	0.27°	1.27
Taimela et al.[69]*	2008	RCT	Finland	1	Large	Construction	134	138	HRA,Ind	EUR	2004	3.47ψ	4.47
Shi et al.[35]	1993	Non-exp	USA	1.5	Large+	El-Gas-Oil-W	412	412ǂ	HRA	USD	1988	1.49~	2.49
							301	301ǂ	+ SH			1.37~	2.37
							295	295ǂ	+ Sm,N,Wt,R,PA,MH, CM			3.07~	4.07
							180	180ǂ	+ Dx, Ind			1.43~	2.43
Medical/Dental programs													
At'kov et al.[42]*	2011	Quasi	Russia	0.67	Large+	Transport	701	630	Vacc	EUR	2006	0.40ψ	1.40
Bridges et al.[51]*	2001	RCT	USA	0.42	NS	Manufacturing	587	604	Vacc	USD	1999	-0.45~	0.55
Cohen et al.[41]*	2003	RCT	Australia	0.12	Large+	Manufacturing	280	270	Vacc	AUD	NS	0.92ψ	1.92
Colombo et al.[52]*	2006	Quasi	Italy	0.4	Large	Health	107	107	Vacc	EUR	NS	3.16ψ	4.16
Samad et al.[54]*	2006	Quasi	Malaysia	0.08	Large	El-Gas-Oil-W	504	518	Vacc	USD	2001	3.02ψ	4.02
Morales et al.[55]*	2004	Quasi	Columbia	0.02	Large	Finance	423	335	Vacc	USD	NS	2.60ψ	3.60
Campbell et al.[50]*	1997	Quasi	USA	0.46	NS	Manufacturing	131	131	Vacc	USD	NS	-3.80~	-2.80
CATEGORISED MODERATE QUALITY (N=14); QUALITY SCORE 50-75%													
Traditional health promotion programs													
Goetzel et al.[63] *	2005	Model	USA	10	Large+	El-Gas-Oil-W	25828	25828ɸ	HRA,CM	USD	2001	0.76°	1.76
Baker et al.[38]	2008	Model	USA	1	Various	Various	890	890ɸ	HRA,N,Wt,PA,Ind	USD	2007	0.17~	1.17
Ozminkowski et al.[36]	1999	Quasi	USA	0.97	Large+	Finance	11194	11644	HRA,Dx,Ind	USD	1996	3.56°	4.56
Mills et al.[61]	2007	Quasi	UK	1	NS	Manufacturing	618	2500	HRA,N,PA,MH,SF,Ind	GBP	NS	27.71ψ	28.71
Bertera et al.[49]	1990	Quasi	USA	2	Large+	Manufacturing	29315	14573	HRA,Sm,N,Wt,PA,MH, Psych,CM,Dental	USD	1986	0.22ψ	1.22

Nyman et al.[34]*	2012	Quasi	USA	3	Large+	Education	6413‖	6413‖	HRA,PA,Dx	USD	2008	0.46˜	1.46
Aldana et al.[76]	1993	Quasi	USA	2	PS	Local Gov	340	340	HRA,CM,Screen,Ind	USD	1990	2.60°	3.60
Schwartz et al.[33]*	2010	Model	USA	1	Large+	Insurance	413	360ᶲ	Dx	USD	2008	3.20°	4.20
Golaszewski et al.[64]	1992	Model	USA	14	Large+	Insurance	NS	NSᶲ	HRA,Wt,PA,MH,CM,Dx	USD	1986	2.10˜	3.10
Medical/Dental programs													
Ichihashi et al.[48]*	2007	Quasi	Japan	7	Small	Manufacturing	103	35	Dental (light)	USD	1992	-3.45˜	-2.45
							160		Dental (medium)			0.46˜	1.46
							59		Dental (heavy)			-0.27˜	0.73
Schneider et al.[57]*	2011	Model	Germany	0.25	Large	Retail	3958	3958	HRA,Screen	EUR	2009	1.15ᶲ	2.15
Dille et al.[53]*	1999	RCT	USA	0.25	Large+	El-Gas-Oil-W	789	931	Vacc	USD	1994	4.00˜	5.00
Schrammel et al.[58]*	1998	Model	USA	6	Large	Sci&Tech	1416	1416ᶲ	Screen	USD	1996	1.95˜	2.95
Kumpulainen et al.[57]*	1997	Quasi	Finland	0	PS	Health	165	186	Vacc	FIM	1991	-0.90˜	0.10
CATEGORISED LOW QUALITY (N=22); QUALITY SCORE <50%													
Traditional health promotion programs													
Foote et al.[84]	1991	Quasi	USA	3	NS	Manufacturing	337	169	CM	USD	1982	1.50°	2.50
							367		+ followup			0.89°	1.89
							183		+tmt			1.72°	2.72
Wood et al.[44]	1989	Quasi	USA	2	NS	Retail	688	387	HRA,Sm,N,Wt,PA,MH, Screen,Cog	USD	NS	3.00ᶲ	4.00
Aldana et al.[47]	2005	Quasi	USA	2	PS	Education	1264	3575	N,Wt,PA,SF,Cog,Dental	USD	2002	14.6ᶲ	15.6
Henke et al.[37]	2011	Model	USA	6	Large+	Manufacturing	31823	31823ᶲ	HRA,Sm,N,Wt,PA,MH,CM,Screen,Dx,Ind	USD	2009	2.92°	3.92
Yen et al.[75]*	2010	Quasi	USA	7	NS	El-Gas-Oil-W	2036	717	HRA,CM,Dx	USD	2007	0.05˜	1.05
Gibbs et al.[43]	1985	Quasi	USA	5	NS	Insurance	667	892	HRA,Sm,N,Wt,R,PA,CM	USD	1978	0.45°	1.45
Merrill et al.[80]	2011	RCT	USA	5	Large	Local Gov	NS	NS	HRA,Sm,Wt,CM,Ind	USD	NS	2.84°	3.84
Bowne et al.[70]	1984	Non-exp	USA	5	Large	Insurance	184	184ǂ	HRA,PA,Ind	USD	1980	0.43°	1.43
Bertera et al.[81]*	1990	Non-exp	USA	0.12	NS	NS	27	27ǂ	Sm SH	USD	NS	3.01˜	4.01
							43	43ǂ	Sm tmt			2.30˜	3.30
Milani et al.[45]	2009	RCT	USA	0.5	Small/NS	NS	185	154	HRA,Sm,N,Wt,R,PA,MHDx	USD	NS	5.00°	6.00
AHA et al.[62]*	1987	Quasi	USA	0.5	NS	Education	82	70	HRA, Ind	USD	1985	-0.67˜	0.33
							145		+ N,Wt,PA,CM			0.24˜	1.24
Gettman et al.[77]	1986	Quasi	USA	2	NS	El-Gas-Oil-W	453	325	PA	USD	NS	0.07˜	1.07
Leutzinger et al.[72]	1995	Quasi	USA	2	Large+	Transport	1148	1148	HRA,Sm,Wt,MH,CM,Ind	USD	NS	2.24˜	3.24

Windsor et al.[74]*	1989	RCT	USA	3	Large+	Education	190	190ǂ	Sm SH	USD	NS	-0.05~	0.95
							190	190ǂ	+Ind			1.84~	2.84
Shore et al.[59]	1989	Quasi	Canada	0.5	NS	NS	134	NS	HRA	USD	NS	0.41ψ	1.41
Shephard et al.[60]	1992	Quasi	Canada	1	Large	Finance	400	800	HRA,N,PA,MH	CAD	1990	3.85~	4.85
Schultz et al.[73]	2002	Quasi	USA	4	Large	Manufacturing	2596	1593	HRA,Screen	USD	NS	1.65ψ	2.65
Tao et al.[46]*	2009	Quasi	USA	2	Large+	Manufacturing	NS	NS	HRA,R,Psych,Screen, Vacc,Dx	NS	NS	1.60°	2.60
Harris et al.[79]	1986	Non-exp	USA	1	Large	Sci&Tech	NS	NSǂ	Sm,MH,CM	USD	1985	1.54°	2.54
Harvey et al.[83]	1993	Quasi	USA	5	Large+/PS	Local Gov	4000	NS	HRA,Sm,Wt,MH,CM,Ind	USD	NS	0.23°	1.23
Serxner et al.[82]*	1993	Non-exp	USA	1	NS	Retail	12	12ǂ	Sm	USD	NS	0.00°	1.00
Davis et al.[71]*	2009	Non-exp	USA	4	Large	Transport	NS	NSǂ	HRA,Sm,N,Wt,PA,CM, Screen,Ind	USD	NS	1.43~	2.43

ROI: Return on Investment (calculated); BCR: Benefit cost ratio (calculated); RCT: Randomised control trial; Model: Modelled; Non-exp: Non-experimental (ie pre-post only, a before/after comparison group); Quasi: Quasi-experimental (ie a non-randomised comparison group); PS: Public service; Organisation size categories: Small (≤250 employees), Large (>250), Large+ (5000+ employees); HRA: Health Risk Assessment; Sm: Smoking; PA: Physical activity; MH: Stress, resilience, life management, employee assistance program (EAP); Psych: Psych distress, crisis management, anxiety, depression; Ind: Individualised, personalised care; Vacc: Vaccination; Screen: Screening, Health Screening (ie: cancer, mamogram, glucose, etc); Dx: Disease management, case management; Cog: Cognitive; CM: Cardiometabolic (changes in BP, Lipids, and Cholesterol); N: Nutrition; Wt: Weight management; Dental: Dental (light = 1 visit/7yr, medium = 2-4 visits/7yr, heavy = 5-6 visits/7yr); R: Risky behaviour, substance abuse; SF: Sleep and Fatigue; Tmt: treatment either in a clinic or centre utilising health professionals (Drs or nurses); SH: Self-help resources; NS: not stated; USD: US Dollar; EUR: Euro; GBP: British Pound; AUD: Australian Dollar; FIM: Finnish Markka; CAD: Canadian Dollar.

* Studies not previously seen in reviews

ǂ Pre-post design, controls are the participants at baseline

ɸ Modelling studies

ǁ Total participant years (study counted employees who participated during an entire year and subsequent years from 2006-2008 program)

~ Both direct and indirect costs measured (refers to the cost offsets or benefits measured, not program costs)

ψ Only indirect costs measured (refers to the cost offsets or benefits measured, not program costs)

° Only direct costs measured (refers to the cost offsets or benefits measured, not program costs)

Table 2.4 Characteristics of studies that included only direct measurement of claims and records

Studies (N=20)	Year	Study Design	Origin	Duration *(years)*	Organisation Size	Industry	Participant *n*	Control *n*	Intervention	Currency	Time Value	ROI	BCR
CATEGORISED HIGH QUALITY (N=15); QUALITY SCORE >75%													
Traditional health promotion programs													
Meenan et al.[67]	2010	RCT	USA	2	Medium	Hospitality	3346	3612	HRA,N,Wt,Ind	USD	2008	-0.74	0.26
Naydeck et al.[78]	2008	Model	USA	4	Large	Insurance	1892	1892[ϕ]	HRA,Sm,N,Wt,PA,MH,CM, Dx	USD	2005	0.27	1.27
CATEGORISED MODERATE QUALITY (N=14); QUALITY SCORE 50-75%													
Traditional health promotion programs													
Ozminkowski et al.[36]	1999	Quasi	USA	0.97	Large	Finance	11194	11644	HRA,Dx,Ind	USD	1996	3.56	4.56
Nyman et al.[34]*	2012	Quasi	USA	3	Large	Education	6413	6413	HRA,PA,Dx	USD	2008	0.46	1.46
Aldana et al.[76]	1993	Quasi	USA	2	PS	Local Gov	340	340	HRA,CM,Screen,Ind	USD	1990	2.60	3.60
Schwartz et al.[33]*	2010	Model	USA	1	Large	Insurance	413	360[ϕ]	Dx	USD	2008	3.20	4.20
Medical/Dental programs													
Ichihashi et al.[48]*	2007	Quasi	Japan	7	Small	Manufacturing	103	35	Dental (light)	USD	1992	-3.45	-2.45
							160		Dental (medium)			0.46	1.46
							59		Dental (heavy)			-0.27	0.73
Dille et al.[53]*	1999	RCT	USA	0.25	Large	El-Gas-Oil-W	789	931	Vacc	USD	1994	4.00	5.00
CATEGORISED LOW QUALITY (N=22); QUALITY SCORE <50%													
Traditional health promotion programs													
Foote et al.[84]	1991	Quasi	USA	3	NS	Manufacturing	337	169	CM			1.50	2.50
							367		+ follow up	USD	1982	0.89	1.89
							183		+tmt			1.72	2.72
Henke et al.[37]	2011	Model	USA	6	Large+	Manufacturing	31823	31823[ϕ]	HRA,Sm,N,Wt,PA,MH,CM, Screen,Dx,Ind	USD	2009	2.92	3.92
Yen et al.[75]*	2010	Quasi	USA	7	NS	El-Gas-Oil-W	2036	717	HRA,CM,Dx	USD	2007	0.05	1.05
Gibbs et al.[43]	1985	Quasi	USA	5	NS	Insurance	667	892	HRA,Sm,N,Wt,R,PA,CM	USD	1978	0.45	1.45
Merrill et al.[80]	2011	RCT	USA	5	Medium	Local Gov	NS	NS	HRA,Sm,Wt,CM,Ind	USD	NS	2.84	3.84

Milani et al.[45]	2009	RCT	USA	0.5	Small/NS	NS	185	154	HRA,Sm,N,Wt,R,PA,MH,Dx	USD	NS	5.00	6.00
Bowne et al.[70]	1984	Non-exp	USA	5	Large	Insurance	184	184‡	HRA,PA,Ind	USD	1980	0.43	1.43
AHA et al.[62]*	1987	Quasi	USA	0.5	NS	Education	82	70	HRA, Ind	USD	1985	-0.67	0.33
							145		+ N,Wt,PA,CM			0.24	1.24
Gettman et al.[77]	1986	Quasi	USA	2	NS	El-Gas-Oil-W	453	325	PA	USD	NS	0.07	1.07
Shephard et al.[60]	1992	Quasi	Canada	1	Medium	Finance	400	800	HRA,N,PA,MH	CAD	1990	3.85	4.85
Harris et al.[79]	1986	Non-exp	USA	1	Medium	Sci&Tech	NS	NS‡	Sm,MH,CM	USD	1985	1.54	2.54
Davis et al.[71]*	2009	Non-exp	USA	4	Medium	Transport	NS	NS‡	HRA,Sm,N,Wt,PA,CM, Screen,Ind	USD	NS	1.43	2.43

ROI: Return on Investment (calculated); BCR: Benefit cost ratio (calculated); RCT: Randomised control trial; Model: Modelled; Non-exp: Non-experimental (ie pre-post only, a before/after comparison group); Quasi: Quasi-experimental (ie a non-randomised comparison group); PS: Public service; Organisation size categories: Small (≤250 employees), Large (>250), Large+ (5000+ employees); HRA: Health Risk Assessment; Sm: Smoking; PA: Physical activity; MH: Stress, resilience, life management, employee assistance program (EAP); Ind: Individualised, personalised care; Vacc: Vaccination; Screen: Screening, Health Screening (ie: cancer, mamogram, glucose, etc); Dx: Disease management, case management; CM: Cardiometabolic (changes in BP, Lipids, and Cholesterol); N: Nutrition; Wt: Weight management; Dental: Dental (light = 1 visit/7yr, medium = 2-4 visits/7yr, heavy = 5-6 visits/7yr); R: Risky behaviour, substance abuse; Tmt: treatment either in a clinic or centre utilising health professionals (Drs or nurses); NS: not stated; USD: US Dollar; CAD: Canadian Dollar.

* Studies not previously seen in reviews

‡ Pre-post design, controls are the participants at baseline

ᶲ Modelling studies

A review of authors' affiliations revealed the majority of papers had authors from private companies (67%), research institutions (63%), or both. A smaller percentage included co-authors from government (12%), healthcare institutions (10%) and not-for-profit organisations (8%).

The majority of studies were quasi-experimental (n=25). There were six non-experimental, and on nine occasions a modelled economic evaluation was performed. There were eleven randomised controlled trials.

The studies included 261,901 active participants and 122,242 controls. Overwhelmingly the target population for interventions was healthy workers (75%). There were seven studies focussed solely on at-risk workers (14%), one study targeting workers who reported one or more chronic disease condition(s)[34] and one which targeted both at risk and known sufferers of chronic disease.[35] There were three studies whose target population included all three health states.[36-38] Workplace health programs were offered predominantly in private companies (n=33), with other organisations within the educational (schools, colleges and universities), government and healthcare settings represented. Two studies evaluated programs that were offered across multiple organisational types.[39,40]

Company size was categorized either large (> 250 employees) or small to medium (≤ 250 employees) as per Australian usage.[41] Large companies accounted for 59% (n=30) of included studies, of which all but two[42,43] originated from the US and sixteen exceeded 5,000 employees. There were two studies of SMEs, five of a mixture of sizes and 14 studies did not state organisational size.

Sixteen health interventions were represented. Most common was HRA (59%) and programs targeting physical activity (37%), weight management (35%), smoking (29%) and nutrition (29%). Twelve studies evaluated mental health interventions, five of those additionally targeted alcohol consumption[36,44-46] or drug use.[47] There were three dental interventions.[48-50] Ten studies evaluated flu vaccination, of which nine were single interventions[42,43,51-57] and the other offered flu vaccination as part of a myriad of initiatives.[47] Cancer screening programs,[58,59] and HRA as a stand-alone intervention,[36,60] were each evaluated twice.

Multicomponent programs (n=23) were almost exclusively adopted by US-based companies. A Canadian study incorporated HRA, nutrition, physical activity and mental health initiatives[61] and a UK study additionally offered sleep and fatigue education.[62] All other non-US studies were single interventions (n=13).

2.4.3 Characteristics of the economic analysis

The economic perspective was reported as employer,[37,38,42,43,49,51,53,55,56,58,59,61,63-69] societal[40,52] or healthcare.[70] Twenty nine studies did not report an economic perspective.

Program costs were valued from company data in 28 studies,[35,36,40,42-45,48-51,53-56,61,65-76] either alongside or separate to market price,[42,43,50,51,53,57,59,67,69,73,74] budget expenditure,[44,56,58,64,65,68,71,75,77-81] regional cost norms,[40,47,52,57,59,63,67] assigned pricing,[67,74,82,83] or from the literature.[38] Six studies[34,37,39,46,60,84] reported costs without disclosing a valuation method.

Cost offsets were valued mostly from measured changes in productivity (indirect costs) and/or health care (direct costs). Productivity-related benefits were predominantly measured by absenteeism,[35,36,40,42,43,45,48,50-57,59,60,62,63,65-70,72-74,76,78] sometimes in conjunction with presenteeism (on the job productivity gains).[43,56,62,66,68] One study looked at presenteeism in isolation.[39] Reporting of wage costs was variable. Studies reporting productivity loss costs valued a work day using either wage norms,[39,40,58,67,68] an assigned price,[51,52,55,59,63,73,74,78,82] from an average[36,45,49,53,54,56,57,62,65,66,69,76] or from actual individual wage costs,[42,43,48,50] using varied methods of calculation. Five studies did not report a valuation method.[35,60,61,72,75] Direct costs focused on changes in direct medical care,[34-39,44,46,49,51,52,54,57,61,63-65,67,68,71,72,76-81,84,85] health care utilization,[34,47,54,59,65] compensation,[47,73] and life insurance claims.[65] One third of studies assigned direct costs to changes in risk factor prevalence or health status. Direct non-health care costs, such as out-of-pocket expenses for purchases associated with improving health was rarely reported.[67] Health care cost offsets were valued five different ways, on twenty occasions through claims or medical records[34,35,37,38,44,46,49,54,61,63,68,71,72,76-81,85] (Table 2.4), from the literature,[36,52,59,64,65,67,70,75] databases,[39,47,58,73,76,83] health department norms,[54,57,67] and participant self-reporting.[51,67] Two studies did not report any valuation method.[82,84]

The economic design was retrospective (n=23), prospective (n=11), modelled (n=5) or not stated (n=12). Fourteen studies appraised benefits based on resource cost savings without assigning monetary values to health outcomes. In these instances the effect measure was classified as cost comparisons.[35,36,38,47,61,63-65,71,73,75,77,80,82,83] Twenty nine studies had a follow-up evaluation greater than 1 year for which 10 studies (34%) discounted costs.[35,37,44,49,58,64-66,68,79] A reported ROI was published in 23 studies for which 83% required recalculation to ensure consistency of ROI metric. The use of a benefit cost ratio (benefits divided by costs) defined as the ROI was the most common cause for recalculation.

2.4.4 Methodological quality assessment

Overall mean ±SD BMJ checklist score was 57±23% further classified into study design (67±24%), data collection, (64±24%) and analysis and interpretation (48±26%). Despite wide variability in scores, studies published after year 2000 consistently performed better on all methodological quality criteria. With one exception[51] studies published pre-2000 did not score highly (>75% as described in methods section).

Although quality scores using all three checklists were similar, the average score on the BMJ checklist was around seven percentage points higher than either the mean CHEC-List score (50±27%) or the mean NICE checklist score (50±25%). The close linear relationship between the CHEC-List score and the BMJ checklist score (correlation r = 0.93) is depicted in Figure 2.2. The correlation between the CHEC-List score and the NICE checklist score was r = 0.92, and between the BMJ checklist score and the NICE score was r = 0.84. Bland-Altman plots[86] did not reveal systematic patterns in the differences other than the consistently higher scoring with the BMJ checklist. Refer Appendix 2C Supplemental Table 2C.2 and 2C.3.

There was a positive correlation between quality score and year with methodological quality improving by 1.15% each year across all studies. Mean score was 38±7% for 1984–1989 (n=8), 51±18% for 1990- 1999 (n=15), 66±25% for 2000-2009 (n=18), and 67±22% for 2010-2012 (n=10).

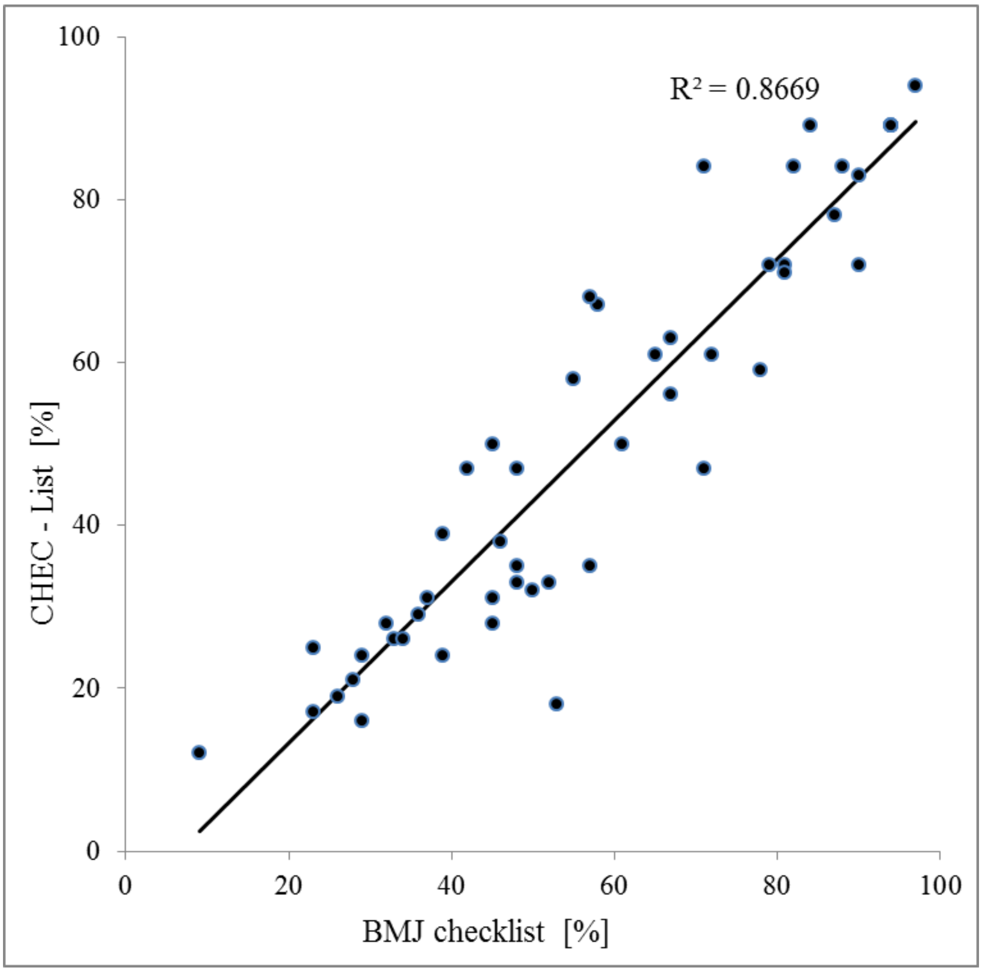

Figure 2.2 Linear relationship between scores on BMJ and CHEC-List quality checklist

CHEC-List: Consensus Health Economic Criteria list14 BMJ: British Medical Journal Economic Evaluation Working Party checklist[23]

Appendix 2C Supplemental Table 2C.4. This table provides an overview of the scoring marks from the 36-item BMJ checklist. If a question was able to be answered, ie: criteria was reported within the study, the study would receive a 'yes' response for that question. Table 2C.2 provides the mean number of 'yes' 'no' and 'not applicable' scores for all studies, presented firstly as summed then as a percentage of 'yes' per individual question (overall and for studies published pre year 2000 and post 2000).

Table 2C.4 is found on page 139.

2.4.5 Synthesis of results

Mean and weighted mean ROI results are found in Table 2.5. Six studies reported subsequent intervention arm(s) alongside a control[49,63,85] or pre-post design[36,75,82] which produced an additional ten outcome measures for an effective sample of 61 comparisons.

Cost benefit analysis was adopted in 58 comparisons with 45 reporting an ROI. Four comparisons applied cost-effectiveness analyses additional to a CBA.[51,57,67,69] The ROI metric could be calculated during data extraction in all instances where the ROI was not reported.

Although three studies, each a single comparative analysis, did not conduct a CBA[40,43,70] the ROI could be calculated. For example, the authors who performed a cost utility analysis[40] reported an incremental net benefit alongside program cost data.

Overall weighted mean ROI was 1.38 ± 1.97(1.37-1.39). Financial return increased under worsening methodological quality. For high quality studies the ROI was 0.26 ± 1.74 (0.23 - 0.3) (min: -4.3 max: 3.47), which increased in moderate quality to 0.9 ± 1.25 (0.9 – 0.91) (min: 3.45 max: 7.97) and was highest in low quality studies, 2.32 ± 2.14 (2.30 - 2.33) (min: 0 max: 14.60). The same inverse relationship was demonstrated for study design. The ROI was negative for RCTs -0.22 ± 2.41 (-0.27 to -0.16) (min: -4.3 max: 5) and increasingly positive across quasi-experimental, non-experimental and modelled studies (1.12 ± 2.16 (1.11 - 1.14) (min: -3.90 max: 14.60), 1.61 ± 0.91 (1.56 - 1.65) (min: 0.00 max: 3.07), and 2.05 ± 0.88 (2.04 – 2.06) (min: 0.17 max: 3.42) respectively). These findings attest to the impact rigor (both of economic quality and study design) has on reported financial outcome. There was a negative return of investment in 7 studies[40,49,51,52,67-69] all but one[68] were single component programs. The sample size (number of participated employees) indicated that higher participation numbers resulted in higher ROI however this relationship was not supported in the weighted analysis. By origin, US studies demonstrated a mean weighted ROI 1.37 ± 1.8 (1.36 - 1.38) (min: -3.90 max: 14.60) which was marginally higher than the non-US studies ROI of 1.23 ± 2.72 (1.18 - 1.29) (min: -4.30 max: 7.97). We compared the ROI imputed in this synthesis against the ROI reported in the original analysis (19 of 23 studies reporting an ROI required recalculation to ensure consistency of metric). The original reported ROI was approximately $1 higher, 3.41 ± 3.23 (2.15 - 4.67), and would report an additional $1 return, than our imputed ROI 2.21 ± 3.23 (0.96 - 3.46). This is explained by the fact that many of these studies define return on investment as ROI = Benefits/Costs instead of the ROI = (Benefits-Costs)/Costs formula used in this analysis. The weighted analysis minimised this effect. Mean weighted ROI as reported was 1.67 ± 2.15 (1.67 - 1.68)(min: 0.32 max: 15.6) only slightly higher than our imputed mean weighted ROI 1.5 ± 1.88 (1.49 - 1.51) (min:-3.9 max:14.6) after recalculation. Studies that measured both direct (ie: medical) and indirect (ie: productivity loss) costs showed a smaller ROI than studies that measured only a single cost category. This was true for both weighted and unweighted analyses. Further analysis of studies incorporating indirect costs, either alone or alongside direct costs, showed that the method used to value a lost workday impacted the ROI result. The largest ROI occurred when actual individual wage costs were measured however this was not seen after weighting (Table 2.5).

Table 2.5 Financial return (mean ROI)

		ROI ± SD (Lower and Upper 95% Confidence Interval)		
		Studies (N)		Weighted*
Overall		61	1.51 ± 2.6 (0.84 - 2.18)	1.38 ± 1.97 (1.38 - 1.39)
Quality	*High*	18	0.79 ± 2.3 (-0.35 - 1.94)	0.26 ± 1.74 (0.23 - 0.3)
	Moderate	16	1.5 ± 2.54 (0.15 - 2.85)	0.9 ± 1.25 (0.9 - 0.91)
	Low	27	2 ± 2.86 (0.87 - 3.13)	2.32 ± 2.14 (2.3 - 2.33)
Origin	*US*	44	1.7 ± 2.54 (0.93 - 2.47)	1.37 ± 1.8 (1.36 - 1.38)
	Non-US	17	1.03 ± 2.88 (-0.45 - 2.51)	1.23 ± 2.72 (1.18 - 1.29)
Year	*Post 2000*	30	1.71 ± 3.39 (0.45 - 2.98)	1.58 ± 2.19 (1.57 - 1.59)
	Pre 2000	31	1.32 ± 1.63 (0.72 - 1.91)	1.05 ± 1.55 (1.03 - 1.06)
Study design	*RCT*	12	0.97 ± 2.59 (-0.68 - 2.61)	-0.22 ± 2.41 (-0.27 - -0.16)
	Quasi-experimental	30	1.62 ± 3.3 (0.39 - 2.85)	1.12 ± 2.16 (1.11 - 1.14)
	Non-experimental	10	1.61 ± 0.98 (0.9 - 2.31)	1.61 ± 0.91 (1.56 - 1.65)
	Modelled	9	1.77 ± 1.25 (0.81 - 2.73)	2.05 ± 0.88 (2.04 - 2.06)
Sample size$^{\phi}$	*<500*	33	1.18 ± 1.96 (0.49 - 1.88)	1.72 ± 1.49 (1.69 - 1.76)
	500-999	9	1.58 ± 3.43 (-1.05 - 4.22)	1.42 ± 3.3 (1.34 - 1.5)
	1000-4999	9	2.38 ± 4.69 (-1.23 - 5.98)	0.58 ± 1.72 (0.56 - 0.59)
	≥5000	10	1.74 ± 1.11 (0.95 - 2.54)	1.55 ± 1.31 (1.54 - 1.56)
Intervention focus	*Vaccination*	9	0.98 ± 2.51 (-0.95 - 2.91)	1.8 ± 1.67 (1.74 - 1.86)
	SNAPS	46	1.81 ± 2.7 (1.01 - 2.61)	1.39 ± 2 (1.38 - 1.4)
	Other	6	0.04 ± 1.87 (-1.92 - 2)	1.31 ± 0.43 (1.3 - 1.32)
Multi-component		27	2.31 ± 3.09 (1.08 - 3.53)	1.08 ± 2.25 (1.07 - 1.09)
Single intervention		34	0.88 ± 2.02 (0.17 - 1.59)	1.5 ± 1.38 (1.49 - 1.52)

Effect measure	*Incremental*	39	1.47 ± 3.19 (0.44 - 2.51)	1.02 ± 2.46 (1 - 1.04)
	Cost comparison	22	1.58 ± 1.16 (1.07 - 2.1)	1.89 ± 1.04 (1.88 - 1.89)
Studies previously not seen		30	0.88 ± 2.13 (0.08 - 1.67)	0.83 ± 0.94 (0.82 - 0.84)
°ROI imputed		28	2.21 ± 3.23 (0.96 - 3.46)	1.5 ± 1.88 (1.49 - 1.51)
~ROI reported		28	3.41 ± 3.23 (2.15 - 4.67)	1.67 ± 2.15 (1.67 - 1.68)
Measured costs	*Direct*[ψ]	17	1.74 ± 1.42 (1.01 - 2.46)	2.29 ± 0.95 (2.28 - 2.3)
	Indirect	16	2.56 ± 4.12 (0.37 - 4.76)	0.68 ± 2.17 (0.66 - 0.7)
	Both	28	0.77 ± 1.87 (0.05 - 1.5)	0.55 ± 1.38 (0.54 - 0.57)
Valuation of direct costs	*Claims and Records* [ǂ]	25[℧]	1.33 ± 1.88 (0.55 - 2.1)	2.74 ± 0.7 (2.74 - 2.75)
Valuation of indirect costs	*Wage norms*[a]	5	-0.79 ± 2.08 (-3.38 - 1.79)	0.31 ± 0.78 (0.29 - 0.33)
	Assigned price[b]	11	0.94 ± 2.08 (-0.46 - 2.33)	1.74 ± 0.66 (1.72 - 1.75)
	Means[c]	17	1.69 ± 2.52 (0.4 - 2.99)	1.96 ± 2.65 (1.9 - 2.02)
	Individual[d]	4	4.04 ± 7.05 (-7.18 - 15.25)	0.22 ± 0.01 (0.22 - 0.22)

ROI: return on investment. SD: standard deviation. RCT: randomised control trial. SNAPS: programs targeting smoking, nutrition, alcohol, physical activity and/or stress

*** weighted by those exposed to the program and transformed to account for skew**

[Φ] sample size is the number of participants in the treatment arm(s)

° ROI recalculated to ensure consistency of ROI metric

~ ROI as it was presented in original analysis

[ψ] direct costs were valued five ways; claims and medical records, from the literature, databases, health department norms, and participant self-reporting

ǂ those studies reporting direct costs with the source of valuation from employee claims or medical records

[℧] Large participant number in Henke moved the ROI considerably upon weighting. Weighted analysis (excluding Henke) for claims and records was 1.75±0.01(1.72-1.76)

[a] studies reporting indirect costs sourced through wage norms such as population norms for specific job categories, country norms

[b] studies reporting indirect costs where a price was assigned for all

[c] studies reporting indirect costs where an average derived cost was used for all

[d] studies reporting indirect costs where actual individual cost data was used

Regression analysis was undertaken to see which of the study characteristics had a greater effect on ROI (Table 2.6). We found methodological quality and measured costs to be significant ($p<0.01$) with low quality studies purporting financial returns several times those of high quality studies, and evaluations measuring only direct costs significantly more likely to show higher returns than evaluations which included both direct and indirect costs.

Table 2.6 Univariable and multivariable regression analysis of ROI

Study Characteristics		Unadjusted		Adjusted‡	
		β	CI	β	CI
Quality	High	Ref			
	Moderate	1.30	(-0.35 – 2.96)	0.97	(-0.73 – 2.67)
	Low	2.94	(1.03 - 4.85)	2.38	(0.38 – 4.37)
	p value	*p<0.01*		*p<0.01*	
Origin	Non-US	Ref		Ref	
	US	0.70	(-1.22 – 2.62)	-0.33	(-2.25 – 1.58)

	p value	*p=0.467*		*p=0.729*	
Year	Pre 2000	Ref		Ref	
	Post 2000	0.48	(-0.52 – 1.48)	0.09	(-0.83 – 1.02)
	p value	*p=0.343*		*p=0.837*	
Study design	RCT	Ref		Ref	
	Quasi-experimental	2.08	(-0.24 – 4.41)	0.50	(-1.83 – 2.82)
	Non-experimental	2.81	(-3.54 – 9.16)	2.66	(-3.13 – 8.46)
	Modelled	2.69	(0.37 – 5.00)	0.38	(-2.22 – 2.99)
	p value	*p=0.057*		*p=0.971*	
Intervention focus	Vaccination	Ref		Ref	
	SNAPS	0.09	(-3.02 – 3.20)	-1.98	(-5.23 – 1.28)
	Other	-0.14	(-4.04 – 3.75)	-1.20	(-4.30 – 1.90)
	p value	*p=0.912*		*p=0.664*	
Program	Multi-component	Ref		Ref	
	Single intervention	-0.11	(-1.13 – 0.91)	0.34	(-0.72 – 1.39)
	p value	*p=0.837*		*p=0.525*	
Effect measure	Incremental	Ref		Ref	
	Cost comparison	0.72	(-0.25 – 1.70)	-0.14	(-1.13 – 0.85)
	p value	*p=0.143*		*p=0.775*	
Measured costs	Direct	Ref		Ref	
	Indirect	-1.19	(-2.21 - -0.18)	-0.69	(-1.71 – 0.33)
	Both	-1.42	(-2.67 - -0.17)	-0.86	(-2.13 – 0.41)
	p value	*p<0.01*		*p=0.117*	
Valuation of indirect costs	Wage norms		Ref		Ref
	Assigned price	2.18	(-1.03 – 5.39)	1.11	(-1.83 – 4.05)
	Means	2.81	(-0.56 – 6.17)	2.23	(-0.87 – 5.33)
	Individual	1.24	(-0.96 – 3.43)	0.42	(-1.64 – 2.49)
	p value	*p=0.058*		*p=0.781*	

‡ Adjusted for methodological quality and measured costs.

2.5 Discussion

This review critically appraised full economic evaluations of both single and multicomponent workplace health programs and summarised the reported evidence using mean ROI weighted by participant numbers. The main finding (Table 2.5) revealed workplace health programs generated a positive return-on-investment, evidenced in all instances except randomised control trials. This study also yielded a methodological quality finding in which the ROI had a propensity to change in relation to methodological quality, whereby the highest quality studies demonstrated smaller returns.

Pooling of results demonstrated a weighted mean ROI 1.38 ± 1.80 (1.38 - 1.39) [unweighted ROI 1.51 ± 2.60 (0.84 - 2.18)]. When subjected to sensitivity analyses, a smaller return was seen in studies of high economic quality, when both direct and indirect costs were measured, and in studies with a control. This trend was seen in both weighted and unweighted results, although the differences were insignificant outside quality. Highest ROI figures were reported in low methodological quality studies, in those that reported only direct costs (to a greater extent when the valuation method for direct costs came from claims or medical records), in cost comparison analyses and where economic modelling occurred. The high returns found in modelled studies could be due to projecting the benefits further into the future. A negative ROI was found in studies with a RCT design. There was a shift in ROI upon weighting for stratifications of 'measured costs' and 'valuation of indirect costs' as well as multicomponent versus single-intervention programs. While multicomponent programs, by virtue of being more comprehensive, could be expected to have a wider impact, only in the unweighted results did it demonstrate a greater positive ROI. Therefore, single intervention programs offered higher financial return after accounting for the number exposed to the intervention and skew. Studies that measured indirect costs and those that valued wage costs at an individual level saw similar disagreement once data were weighted. This was due to a single study[48] outlier with a large positive ROI and a participant sample of 1,264 employees. The heavy right skew was accounted for upon weighting. Removal of it from the analysis did not significantly alter the weighted results.

After adjustment, our regression analyses showed that methodological quality was a significant predictor of ROI, with studies of higher methodological quality tending to have lower ROI. In so doing, we have highlighted the impact robust economic evaluations can have and emphasised the practical importance of good quality economic evaluations in limiting over-estimation of economic outcomes.

Although our finding of an overall positive return on investment was congruent with previous literature reviews,[6-9,11,87,88] and that RCT designs do not show positive financial returns supported by others,[5,89] we demonstrated that the magnitude of positive return was lower than previously reported. Much of the difference is because of the difference in the formula used to calculate ROI. If we had used ROI = Benefits/Costs, our overall weighted ROI would have been 2.38 instead of 1.38.

Strengths of this review include the use of economic databases and economic search filters alongside biomedical standards, the inclusion of studies that only met the definition of a full economic evaluation and the assessment of methodological quality by multiple checklists. Our quality assessment scored economic elements, known to have important impacts on the validity of findings, for each study evaluation. Although the BMJ Checklist is recommended[18,19] and considered most reliable,[15] a valid scoring method to reflect the assessment of methodological quality remains elusive.[15] Also relevant to this review, economic quality checklists, including the ones we used, have been developed largely for assessment of cost-effectiveness (cost-utility) studies rather than cost benefit analyses. The impact of this on our quality scores was viewed to be low. First, the identification, measurement and valuation of costs and benefits are fundamental across all evaluation methods and second, for items specific to cost-effectiveness (cost-utility) analysis, CBA studies received a NA, and scores were expressed as a percentage of the applicable items.

High correlation of quality scores obtained during sensitivity analysis against the CHEC-List[14] and NICE study limitations checklist[20] was an expected finding due to the similarity of components within them. We demonstrated that economic evaluations in WHP are of low to moderate methodological quality. Methodological strength in the analysis and interpretation of results was most lacking. Our findings reflect a similar quality score finding of 51 ± 34% (tallied from the CHEC-List) from a review of eighteen workplace health programs aimed at improving nutrition and/or increasing physical activity.[5]

Our study offers a resource for stakeholders wishing to improve the methodology of evidence in WHP. High methodological-quality studies were a critically missing element found in a recent review by Lerner and colleagues[4] who concluded no positive, negative or neutral ROI could be made in light of methodological limitations. We were able to reconcile this limitation and report an aggregate ROI by accounting for differences in methodological quality in regression analysis. Pelletier[11] in the latest of a series of reviews spanning 20 years adopted cautious optimism about the cost-effectiveness of WHP, highlighting the increasing number of RCT studies in this field were having an effect on bold positive conclusions. Our negative ROI findings from RCT's support this. Neither author investigated the association of economic methodological quality with financial outcome.

Our methods resulted in fifty one empirical studies, twenty five not seen in previous reviews.[4-7,9] Many previously reviewed were excluded from this review for failing to meet the economic inclusion criteria.[28,90-120] The inclusion of single interventions played a major role in this new body of evidence, accounting for nineteen new studies. Previous reviews have focussed on multicomponent programs,[7,10] research conducted within the United States,[4,11] included only studies solely targeted nutrition and/or physical activity[5] or mental health interventions[89] or, like Baicker et al,[6] included studies with no reported program costs.

At its time of publication, the Baicker et al review offered the most systematic treatment of research design and calculation of equivalent costs and benefits, and demonstrated a more modest ROI than previously seen (2.73 for programs measuring absenteeism and 3.27 when targeting healthcare costs). Although ten studies were also included in our review,[36,37,44,45,48,50,62,74,77,79] due to methodological differences it is difficult to make direct comparisons. Our approach and subsequent results differ from Baicker et al in terms of the comprehensiveness of the search strategy, the economic rigor of included studies, and the method of data analysis. The primary contributor to the difference in ROI reported by Baicker et al was the method of ROI calculation. The ROI formula used by Baicker was ROI=Benefit/Costs. When we adopted this formula our overall mean weighted ROI was 2.38. The costing assumptions applied by Baicker et.al introduced uncertainty to their results. Their use of a price year (2009 US dollars) for which program costs and healthcare benefits were standardised, assumed a linear distribution of price over time and additionally assumed no change in service provision despite publications spanning three decades. Program costs were not reported in 32% of studies measuring healthcare cost savings and 55% of studies measuring absenteeism, instead, these studies were assigned a program cost from an average cost (an average of those that did report program costs). The cost of absenteeism was derived from the number of absentee days (extracted) then monetised by assuming an 8 hour work day at a US uniform wage rate of $20.49 per hour.[121] In addition, Baicker et al did not perform any sensitivity analysis against these cost assumptions, and aside from rough estimates across RCT or matched control groups, non-randomised or unmatched control groups and post-intervention only studies, there were no sensitivity analyses for other key study characteristics. We believe our method of incorporating economic evidence, the extraction of ROI ratios at the time point and locale of each study, our standardisation of the ROI calculation, the weighting for participant numbers, and the sensitivity analyses undertaken to test the robustness of conclusions, all add to the confidence that can be placed in our findings. Moreover, in contrast to Baicker et.al, our summary ROI values have been estimated using minimal cost assumptions.

These findings offer employers and policy makers an empirically sound basis to scrutinise the financial outcomes of WHP and provide better evidence to assist more sustainable business justification. Ultimately, it reinforces that a positive return-on-investment is probable, although considerable scrutiny and critical appraisal of published return figures are needed to be confident of the degree of magnitude; in particular, the quality of the economic evaluation, the study design, how the ROI was calculated and what method of valuation was used. The ROI may be inflated if the study reports only healthcare costs, does not report an incremental analysis (difference calculation between treatment and control) or reports ROI using the benefit/cost formula. Vaccination programs in the workplace were demonstrated to be most worthwhile. They showed higher returns than those programs targeting chronic disease or dental/screening, and in addition, studies evaluating vaccination programs were of moderate/high quality and some were of RCT design.

The evaluation of vaccination interventions to our knowledge has never been incorporated in reviews of this kind. There are many health interventions to consider when implementing a workplace health program and in an attempt to identify and review the broadest program offerings available in the literature, vaccination was considered a relevant addition.

Our assessment of methodological quality attempted to ascertain how near the 'truth' our findings were likely to be. A subgroup analysis revealed higher methodological quality studies were more likely to be recently published, often of RCT design, and evaluated single interventions. In contrast, low methodological quality studies offered a most favourable return. In the interest of business justification, higher return studies are enticing, yet economic findings derived from poorer method may be less robust and undermine generalisability due to their limited transparency, applicability and uncertainty of result, which the methodological quality score reflects.[13,14,23]

Methodological quality has improved at a rate of 1.15% each year. The greatest improvements were seen in the reporting of perspective, methods for estimation of resource consumption, discount rates, and performance of appropriate sensitivity analysis, all of which improved by 30% or more in studies published after year 2000. Although this attests to an improved methodology, an urgent need still exists for reporting unit costs, discount rates, performing sensitivity analyses and addressing generalizability, which despite improvements over the time period continue to be the most poorly addressed aspects of included studies. Advances in reporting standards for economic evaluations have recently been published[22] to assist evaluators in this endeavour.

2.5.1 Limitations

Although the majority of economic evaluations in healthcare literature are conducted by means of CEA followed by CUA,[122] CBA is the predominant methodology in workplace health studies. Yet despite being a good fit, the concerns surrounding the application of CBA in health-related literature, as investigated almost two decades ago,[123] continue to apply to economic evaluations in WHP. Although every effort was made in this review to capture studies that met the standard definition of a full economic evaluation, and in principle to be of sound methodological quality, there was strong evidence of inconsistencies in both the calculation of the ROI metric and the valuation of benefits in these studies.

Our efforts meant that we also captured a few studies that conducted CEA and CUA evaluations, and some that reported CBA as a net benefit (Benefit-Cost). In our attempt to calculate the ROI for studies that did not do so in their original form the authors recognise the implicit risks of miscalculation and they made every attempt to accurately attribute ROI figures from the original published data.

Development of a CBA framework for workplace health evaluation to standardise method and offer the much sought-after return on investment figure is a research priority. Of particular note is the valuation of benefits. Coupled with the vast array of methods for how to place value on a unit measure of benefit, benefits were largely limited to direct medical care cost savings and indirect productivity loss savings as a result of absenteeism. Consequently, studies often offered only partial program evaluation and therefore conclusions about the overall profitability of WHP are not complete.

In addition, there was a lack of reported “opportunity cost”. Few studies compared the intervention alongside a competing program option. Yet, the role of an economic evaluation is to assess the cost of a program considering the costs of an alternative program that has been foregone due to the commitment of resources to the former.[23] Without consideration of opportunity costs alongside achieved benefits, calculating real program costs is elusive. Therefore, the basis on which we judge value for money in WHP is imperfect.

Importantly, the economic quality checklists offered no specificity to key elements in WHP, such as the quality of the intervention, the appropriateness of its focus given the health needs of the population, or the appropriateness of the dose or duration. As such, the quality scores represent only the quality of the economic evaluation.

There was a low representation of small to medium enterprises in this review, indicating limited published evaluations of WHP in the SME population. With 99.9% of workplaces in the United Kingdom[124] and 99.7% workplaces in Australia[125] defined as SME, the lack of evidence in small organisations limits generalisability and may reflect poor engagement, potential publication biases or a lack of resources or interest by SME operators or researchers to evaluate financial returns in this setting.[126]

2.5.2 Conclusion

This methodological quality-based review of single and multi-component WHP programs demonstrated that higher methodological quality studies provided evidence of smaller financial returns. The overall mean weighted ROI for workplace health promotion was positive but methodological quality and study type were important determinants of economic outcome. We found that as methodological quality improved, return on investment decreased, and we found a negative ROI in randomised control trials. It is important for stakeholders who evaluate their investment in workplace health to use the highest possible methodological quality evaluation methods.

2.6 SO WHAT? Section

What is already known on this topic?

Economic evaluations of workplace health interventions are used to measure the financial impact of health-promoting initiatives. Traditionally, cost benefit analyses (CBA) have been undertaken, from an employer perspective, to assess allocation efficiency and determine whether or not the intervention is worthwhile. It is known that economic analytical techniques are variable in methodological quality, and decision makers must use extreme caution in the interpretation of economic outcomes.

What does this article add?

This review offers empirical evidence under methodological scrutiny of the financial impact of workplace health promotion. It applies economic quality checklists to a strong body of published economic evidence, and offers the most comprehensive summary estimate of return on investment (ROI). It identifies important determinants of ROI to be methodological quality, study design, how the ROI was calculated and what method of valuation was used in the economic evaluation.

What are the implications for health promotion practice or research?

These findings offer employers and policy makers better evidence to make more accurate and sustainable business justifications. Although a positive return-on-investment is probable, considerable critical appraisal of published return figures are needed to increase confidence in the degree of magnitude. For stakeholders who evaluate investment in workplace health, engaging the highest possible methodological quality evaluation methods will maximise efficient resource allocation. Researchers must ensure economic evaluations are based on comparative analyses of both program costs and health outcomes to limit over-estimation of economic outcomes.

2.7 Summary

Objective: To determine the relationship between return on investment (ROI) and quality of study methodology in workplace health promotion programs.

Methods: A systematic literature search of NHS EED, DARE, HTA, CEA registry, EconLit, PubMed, Embase, Wiley and Scopus. Articles written in English or German reporting cost(s) and benefit(s), single or multicomponent health promotion programs on working adults were included. Return-to-work and workplace injury prevention studies were excluded. Methodological quality was graded using British Medical Journal Economic Evaluation Working Party checklist. Economic outcomes were presented as return on investment (ROI). ROI was calculated as ROI= (Benefits – Costs of program)/Costs of program. Results were weighted by study size and combined using meta-analysis techniques. Sensitivity analysis was performed using two additional methodological quality checklists. The influences of quality score and important study characteristics on ROI were explored.

Findings: Fifty one studies (61 intervention arms) published between 1984–2012 included 261,901 participants and 122,242 controls from 9 industry types across 12 countries. Methodological quality scores were highly correlated between checklists (r=0.84–0.93). Methodological quality improved over time. Overall weighted ROI [mean ± SD (CI)] was 1.38±1.97 (1.38–1.39) which indicated a 138% return-on-investment. When accounting for methodological quality, an inverse relationship to ROI was found. High quality studies (n=18) had a smaller mean ROI 0.26 ± 1.74 (0.23–0.30), compared to moderate (n=16) 0.90 ± 1.25 (0.90–0.91) and low quality studies (n=27) 2.32 ± 2.14 (2.30–2.33). Randomised control trials (RCTs) (n=12) exhibited negative ROI -0.22 ± 2.41 (-0.27– -0.16). Financial returns become increasingly positive across quasi-experimental, non-experimental and modelled studies: 1.12 ± 2.16 (1.11 - 1.14), 1.61 ± 0.91 (1.56 - 1.65), and 2.05 ± 0.88 (2.04 – 2.06) respectively.

Conclusion: Overall mean weighted ROI in workplace health promotion demonstrated a positive ROI. Higher-methodological-quality studies provided evidence of smaller financial returns. Methodological quality and study design are important determinants.

2.8 Postscript

This review was particularly well-received by the WHP research community and leaders in the field.[127-130] It was acknowledged by the editor in chief of the *American Journal of Health Promotion* as "the most thorough and rigorous systematic review of the literature conducted to date on the return on investment (ROI) of workplace health promotion programs" p iv. [127] Its findings have been cited in the American Heart Association Presidential Advisory.[131] The results in this review provide strong support for the need to improve standards of economic evaluations in workplace health promotion.

2.9 References

1. Drummond MF, Sculpher MJ, Torrance GW. *Methods for the economic evaluation of health care programmes 3rd edition.* Oxford University Press, USA; 2005.
2. Warner KE, Wickizer TM, Wolfe RA, Schildroth JE, Samuelson MH. Economic implications of workplace health promotion programs: review of the literature. *J. Occup. Med.* Feb 1988;30(2):106-112.
3. Uegaki K, de Bruijne MC, van der Beek AJ, van Mechelen W, van Tulder MW. Economic Evaluations of Occupational Health Interventions from a Company's Perspective: A Systematic Review of Methods to Estimate the Cost of Health-Related Productivity Loss. *Journal of Occupational Rehabilitation.* Mar 2011;21(1):90-99.
4. Lerner D, Rodday AM, Cohen JT, Rogers WH. A Systematic Review of the Evidence Concerning the Economic Impact of Employee-Focused Health Promotion and Wellness Programs. *J. Occup. Environ. Med.* 2013;55(2):209-222.
5. van Dongen JM, Proper KI, van Wier MF, et al. Systematic review on the financial return of worksite health promotion programmes aimed at improving nutrition and/or increasing physical activity. *Obes Rev.* Dec 2011;12(12):1031-1049.
6. Baicker K, Cutler D, Song Z. Workplace wellness programs can generate savings. *Health Aff. (Millwood).* Feb 2010;29(2):304-311.
7. Chapman LS. Meta-evaluation of worksite health promotion economic return studies: 2012 update. *Am. J. Health Promot.* Mar-Apr 2012;26(4):TAHP1-TAHP12.
8. Goetzel RZ, Juday TR, Ozminkowski RJ. What's the ROI. *A systematic review of return on investment (ROI) studies of corporate health and productivity management initiatives. AWHP's Worksite Health.* 1999:12-21.
9. Aldana SG. Financial impact of health promotion programs: a comprehensive review of the literature. *Am. J. Health Promot.* May-Jun 2001;15(5):296-320.
10. Chapman LS. Meta-evaluation of worksite health promotion economic return studies: 2005 update. *Am. J. Health Promot.* Jul-Aug 2005;19(6):1-11.
11. Pelletier KR. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: update VIII 2008 to 2010. *J. Occup. Environ. Med.* Nov 2011;53(11):1310-1331.
12. Chiou CF, Hay JW, Wallace JF, et al. Development and validation of a grading system for the quality of cost-effectiveness studies. *Med. Care.* Jan 2003;41(1):32-44.
13. Oxman A, Group GW. Grading quality of evidence and strength of recommendations. *BMJ.* 2004;328(19):1490-1494.
14. Evers S, Goossens M, de Vet H, van Tulder M, Ament A. Criteria list for assessment of methodological quality of economic evaluations: Consensus on Health Economic Criteria. *Int. J. Technol. Assess. Health Care.* Spring 2005;21(2):240-245.
15. Centre for Reviews and Dissemination. *Systematic Reviews: CRD's guidance for undertaking reviews in health care, 3rd edn. Available at*

http://www.york.ac.uk/inst/crd/index_guidance.htm Accessed August 4, 2011. York: Centre for Reviews and Dissemination2009.

16. University of York. Database of Abstracts of Reviews of Effects. Available at http://www.crd.york.ac.uk/crdweb/ Accessed October 2011.
17. Shemilt I MM, Vale L, Marsh K, Donaldson C (editors). *Evidence-based decisions and economics : health care, social welfare, education and criminal justice.* 2nd ed. Chichester, West Sussex, UK ; Hoboken, NJ: Wiley-Blackwell/BMJ Books; 2010.
18. Campbell and Cochrane Economics Methods Group. Campbell and Cochrane Economics Methods Group; How to add Health Economics to Cochrane Protocols Available from http://www.c-cemg.org/ [Accessed October 10, 2011].
19. National Institute for Health and Clinical Excellence. *The Guidelines Manual: Chapter 8; Incorportaing health economics in guidelines and assessing resource impact (April 2007) http://www.nice.org.uk/niceMedia/pdf/GuidelinesManualChapter8.pdf*. 2007.
20. National Institute for Health and Clinical Excellence. The Guidelines Manual: Appendix H: Methodology checklist - economic evaluations (January 2009) http://www.nice.org.uk/media/633/71/The_guidelines_manual_2009_-_Appendix_H_Methodology_checklist_-_economic_evaluations.pdf. 2009.
21. Philips Z, Bojke L, Sculpher M, Claxton K, Golder S. Good practice guidelines for decision-analytic modelling in health technology assessment: a review and consolidation of quality assessment. *Pharmacoeconomics.* 2006;24(4):355-371.
22. Husereau D DM, Petrou S, Carswell C, Moher D, Greenberg D, Augustovski F, Briggs AH, Mauskopf J, Loder E,. Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement. *BMC Medicine.* 2013;11(80).
23. Drummond MF, Jefferson TO. Guidelines for authors and peer reviewers of economic submissions to the BMJ. The BMJ Economic Evaluation Working Party. *BMJ.* Aug 3 1996;313(7052):275-283.
24. Stone PW. Return-on-investment models. *Applied nursing research: ANR.* 2005;18(3):186.
25. Finkelstein EA, Linnan LA, Tate DF, Leese PJ. A longitudinal study on the relationship between weight loss, medical expenditures, and absenteeism among overweight employees in the WAY to Health study. *J. Occup. Environ. Med.* Dec 2009;51(12):1367-1373.
26. Deitz D, Cook R, Hersch R. Workplace health promotion and utilization of health services: Follow-up data findings. *Journal of Behavioral Health Services and Research.* 2005;32(3):306-319.
27. Millot JL, Aymard M, Bardol A. Reduced efficiency of influenza vaccine in prevention of influenza-like illness in working adults: A 7 month prospective survey in EDF Gaz de France employees, in Rhône-Alpes, 1996-1997. *Occup. Med.* 2002;52(5):281-292.
28. Serxner S, Gold D, Anderson D, Williams D. The impact of a worksite health promotion program on short-term disability usage. *J. Occup. Environ. Med.* Jan 2001;43(1):25-29.

29. Chung M, Melnyk P, Blue D, Renaud D, Breton MC. Worksite health promotion: The value of the tune Up your heart program. *Population Health Management.* 2009;12(6):297-304.

30. Chenoweth DH, Garrett J. Cost-effectiveness analysis of a worksite clinic: is it worth the cost? *AAOHN journal : official journal of the American Association of Occupational Health Nurses.* 2006;54(2):84-89; quiz 90-91.

31. Ide R, Mizoue T, Tsukiyama Y, Ikeda M, Yoshimura T. Evaluation of oral health promotion in the workplace: the effects on dental care costs and frequency of dental visits. *Community Dent. Oral Epidemiol.* Jun 2001;29(3):213-219.

32. Nelson DJ, Sennett L, Lefebvre RC. A campaign strategy for weight loss at worksites. *Health Educ. Res.* 1987;2(1):27-31.

33. Renaud L, Kishchuk N, Juneau M, Nigam A, Tetreault K, Leblanc MC. Implementation and outcomes of a comprehensive worksite health promotion program. *Canadian Journal of Public Health.* 2008;99(1):73-77.

34. Schwartz SM, Day B, Wildenhaus K, Silberman A, Wang C, Silberman J. The impact of an online disease management program on medical costs among health plan members. *Am. J. Health Promot.* 2010;25(2):126-133.

35. Nyman JA, Abraham JM, Jeffery MM, Barleen NA. The Effectiveness of a Health Promotion Program After 3 Years: Evidence From the University of Minnesota. *Med. Care.* Jun 6 2012;50(9):772-778.

36. Shi L. Health promotion, medical care use, and costs in a sample of worksite employees. *Evaluation Review.* 1993;17(5):475-487.

37. Ozminkowski RJ, Dunn RL, Goetzel RZ, Cantor RI, Murnane J, Harrison M. A return on investment evaluation of the Citibank, N.A., health management program. *Am. J. Health Promot.* Sep-Oct 1999;14(1):31-43.

38. Henke RM, Goetzel RZ, McHugh J, Isaac F. Recent experience in health promotion at Johnson & Johnson: Lower health spending, strong return on investment. *Health Aff. (Millwood).* 2011;30(3):490-499.

39. Baker KM, Goetzel RZ, Pei X, et al. Using a return-on-investment estimation model to evaluate outcomes from an obesity management worksite health promotion program. *J. Occup. Environ. Med.* Sep 2008;50(9):981-990.

40. McEachan RR, Lawton RJ, Jackson C, Conner M, Meads DM, West RM. Testing a workplace physical activity intervention: a cluster randomized controlled trial. *Int J Behav Nutr Phys Act.* 2011;8:29.

41. Australian Government: Department of Innovation Industry Science and Research. *Key Statistics: Australian Small Businesses.* Canberra ACT2011.

42. Cohen P, Darling C, Hampson A, Downs K, Tasset-Tisseau A. Influenza vaccination in an occupational setting: effectiveness and cost-benefit study (Structured abstract). *Journal of Occupational Health and Safety - Australia and New Zealand.* 2003(2):167-182. http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-22003009406/frame.html.

43. At'kov O, Azarov A, Zhukov D, Nicoloyannis N, Durand L. Influenza Vaccination in Healthy Working Adults in Russia: Observational Study of Effectiveness and Return on Investment for the Employer. *Applied Health Economics and Health Policy.* 2011;9(2):89-99.

44. Gibbs JO, Mulvaney D, Henes C, Reed RW. Work-site health promotion. Five-year trend in employee health care costs. *J. Occup. Med.* Nov 1985;27(11):826-830.

45. Wood EA, Olmstead GW, Craig JL. An evaluation of lifestyle risk factors and absenteeism after two years in a worksite health promotion program. *Am. J. Health Promot.* 1989;4(2):128-133.

46. Milani RV, Lavie CJ. Impact of worksite wellness intervention on cardiac risk factors and one-year health care costs. *Am. J. Cardiol.* Nov 15 2009;104(10):1389-1392.

47. Tao X, Chenoweth D, Alfriend AS, et al. Monitoring worksite clinic performance using a cost-benefit tool. *J. Occup. Environ. Med.* 2009;51(10):1151-1157.

48. Aldana SG, Merrill RM, Price K, Hardy A, Hager R. Financial impact of a comprehensive multisite workplace health promotion program. *Prev. Med.* Feb 2005;40(2):131-137.

49. Ichihashi T, Muto T, Shibuya K. Cost-benefit analysis of a worksite oral-health promotion program. *Ind. Health.* Jan 2007;45(1):32-36.

50. Bertera RL. The effects of workplace health promotion on absenteeism and employment costs in a large industrial population. *Am. J. Public Health.* Sep 1990;80(9):1101-1105.

51. Campbell DS, Rumley MH. Cost-effectiveness of the influenza vaccine in a healthy, working-age population. *J. Occup. Environ. Med.* 1997;39(5):408-414.

52. Bridges CB, Thompson WW, Meltzer MI, et al. Effectiveness and cost-benefit of influenza vaccination of healthy working adults. *JAMA: the journal of the American Medical Association.* 2000;284(13):1655-1663.

53. Colombo GL, Ferro A, Vinci M, Zordan M, Serra G. Cost-benefit analysis of influenza vaccination in a public healthcare unit. *Therapeutics and Clinical Risk Management.* 2006;2(2):219-226.

54. Dille JH. A worksite influenza immunization program: Impact on lost work days, health care utilization, and health care spending. *AAOHN J.* 1999;47(7):301-309.

55. Samad AH, Usul MHBHJ, Zakaria D, et al. Workplace vaccination against influenza in Malaysia: Does the employer benefit? *J. Occ. Health* 2006; 48(1):1-10.

56. Morales A, Martinez MM, Tasset-Tisseau A, Rey E, Baron-Papillon F, Follet A. Costs and benefits of influenza vaccination and work productivity in a Colombian company from the employer's perspective. *Value in Health.* 2004;7(4):433-441.

57. Kumpulainen V, Makela M. Influenza vaccination among healthy employees: a cost-benefit analysis. *Scand. J. Infect. Dis.* 1997(2):181-185. http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-21997000750/frame.html.

58. Schneider M, Häck HJ. Screening for colorectal cancer: A cost benefit analysis on a health prevention programme at the Boehringer Ingelheim Company.

Darmkrebsscreening im betrieblichen Umfeld: Kosten-Nutzen-Analyse einer Maßnahme zur Gesundheitsförderung bei Boehringer Ingelheim. 2011;136(20):1047-1052.

59. Schrammel P, Griffiths RI, Griffiths CB. A workplace breast cancer screening program: Costs and components. *AAOHN J.* 1998;46(11):523-529.
60. Shore G, Prasad P, Zrobak M. Metrofit: A cost-effective fitness program. *Fitness in Business.* 1989;4:147-153.
61. Shephard RJ. Twelve years experience of a fitness program for the salaried employees of a Toronto Life Assurance Company. *Am. J. Health Promot.* 1992;6(4):292-301.
62. Mills PR, Kessler RC, Cooper J, Sullivan S. Impact of a health promotion program on employee health risks and work productivity. *Am. J. Health Promot.* Sep-Oct 2007;22(1):45-53.
63. American Heart Association Division of Planning. *Heart at Work: Technical report, extended field studies.* 1987.
64. Goetzel RZ, Ozminkowski RJ, Baase CM, Billotti GM. Estimating the return-on-investment from changes in employee health risks on the Dow Chemical Company's health care costs. *J. Occup. Environ. Med.* Aug 2005;47(8):759-768.
65. Golaszewski T, Snow D, Lynch W, Yen L, Solomita D. A benefit-to-cost analysis of a work-site health promotion program. *J. Occup. Med.* Dec 1992;34(12):1164-1172.
66. Greene BL, Miller JD, Brown TM, Harshman RS, Richerson GT, Doyle JJ. Economic impact of the BP DownShift Program on blood pressure control among commercial driver license employees. *J. Occup. Environ. Med.* May 2009;51(5):542-553.
67. Groeneveld IF, van Wier MF, Proper KI, Bosmans JE, van Mechelen W, van der Beek AJ. Cost-effectiveness and cost-benefit of a lifestyle intervention for workers in the construction industry at risk for cardiovascular disease. *J. Occup. Environ. Med.* 2011;53(6):610.
68. Meenan RT, Vogt TM, Williams AE, Stevens VJ, Albright CL, Nigg C. Economic evaluation of a worksite obesity prevention and intervention trial among hotel workers in Hawaii. *J. Occup. Environ. Med.* 2010;52(SUPPL. 1):S8-S13.
69. Proper KI, de Bruyne MC, Hildebrandt VH, van der Beek AJ, Meerding WJ, van Mechelen W. Costs, benefits and effectiveness of worksite physical activity counseling from the employer's perspective. *Scand. J. Work. Environ. Health.* 2004;30(1):36-46.
70. Taimela S, Justén S, Aronen P, et al. An occupational health intervention programme for workers at high risk for sickness absence. Cost effectiveness analysis based on a randomised controlled trial. *Occup. Environ. Med.* 2008;65(4):242-248.
71. Bowne DW, Russell ML, Morgan JL, Optenberg SA, Clarke AE. Reduced disability and health care costs in an industrial fitness program. *J. Occup. Environ. Med.* 1984;26(11):809.
72. Davis L, Loyo K, Glowka A, et al. A comprehensive worksite wellness program in

Austin, Texas: partnership between Steps to a Healthier Austin and Capital Metropolitan Transportation Authority. *Preventing chronic disease.* 2009;6(2):A60.

73. Leutzinger J, Hawes C, Hunnicutt D, Richling D. Predicting the ratio of benefit to cost in a cardiovascular disease-prevention program. *Managing Employee Health Benefits.* 1995;3:1-10.
74. Schultz AB, Lu C, Barnett TE, et al. Influence of participation in a worksite health-promotion program on disability days. *J. Occup. Environ. Med.* Aug 2002;44(8):776-780.
75. Windsor RA, Lowe JB. Behavioral impact and cost analysis of a worksite self-help smoking cessation program. *Prog. Clin. Biol. Res.* 1989;293:231-242.
76. Yen L, Schultz AB, Schaefer C, Bloomberg S, Edington DW. Long-term return on investment of an employee health enhancement program at a Midwest utility company from 1999 to 2007. *International Journal of Workplace Health Management.* 2010;3(2):79-96.
77. Aldana SG, Jacobson BH, Harris CJ, Kelley PL, Stone WJ. Influence of a mobile worksite health promotion program on health care costs. *Am. J. Prev. Med.* Nov-Dec 1993;9(6):378-383.
78. Gettman L. Cost/benefit analysis of a corporate fitness program. *Fitness in Business.* 1986;1(1):11-17.
79. Naydeck BL, Pearson JA, Ozminkowski RJ, Day BT, Goetzel RZ. The impact of the highmark employee wellness programs on 4-year healthcare costs. *J. Occup. Environ. Med.* Feb 2008;50(2):146-156.
80. Harris JS. Northern Telecom: A million dollar medically based program in a rapidly changing high tech environment. *Am. J. Health Promot.* 1986;1(1):50-84.
81. Merrill RM, Hyatt B, Aldana SG, Kinnersley D. Lowering Employee Health Care Costs Through the Healthy Lifestyle Incentive Program. *J. Public Health Manag. Pract.* May-Jun 2011;17(3):225-232.
82. Bertera RL, Oehl LK, Telepchak JM. Self-help versus group approaches to smoking cessation in the workplace: Eighteen-month follow-up and cost analysis. *Am. J. Health Promot.* 1990;4(3):187-192.
83. Serxner S, Adams VG, Hundahl LS, Lau S, Adessa Jr CJ, Hopkins D. A smoking cessation pilot program. *Hawaii Med. J.* 1993;52(10):266-272.
84. Harvey MR, Whitmer RW, Hilyer JC, Brown KC. The impact of a comprehensive medical benefit cost management program for the city of Birmingham: results at five years. *Am. J. Health Promot.* 1993;7(4):296-303.
85. Foote A, Erfurt JC. The benefit to cost ratio of work-site blood pressure control programs. *JAMA: the journal of the American Medical Association.* 1991;265(10):1283-1286.
86. Altman DG, Bland JM. Measurement in medicine: the analysis of method comparison studies. *The statistician.* 1983;32(3):307-317.
87. Pelletier KR. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the

worksite: update VI 2000-2004. *J. Occup. Environ. Med.* Oct 2005;47(10):1051-1058.

88. Pelletier KR. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: 1995-1998 update (IV). *Am. J. Health Promot.* Jul-Aug 1999;13(6):333-345, iii.
89. Hamberg-van Reenen HH, Proper KI, van den Berg M. Worksite mental health interventions: a systematic review of economic evaluations. *Occup. Environ. Med.* Aug 3 2012;69:837-845.
90. Shephard RJ, Corey P, Renzland P, Cox M. The influence of an employee fitness and lifestyle modification program upon medical care costs. *Can. J. Public Health.* 1982;73(4):259.
91. Tsai SP, Bernacki EJ, Baun WB. Injury prevalence and associated costs among participants of an employee fitness program. *Prev. Med.* 1988;17(4):475-482.
92. Stein AD, Karel T, Zuidema R. Carrots and sticks: impact of an incentive/disincentive employee flexible credit benefit plan on health status and medical costs. *Am. J. Health Promot.* May-Jun 1999;13(5):260-267.
93. Shimizu T, Nagashima S, Mizoue T, Higashi T, Nagata S. A psychosocial-approached health promotion program at a Japanese worksite. *J UOEH.* Mar 1 2003;25(1):23-34.
94. Shi L. Worksite health promotion and changes in medical care use and sick days. *Health Values: The Journal of Health Behavior, Education & Promotion.* 1993;17(5):9-17.
95. Maes S, Verhoeven C, Kittel F, Scholten H. Effects of a Dutch work-site wellness-health program: the Brabantia Project. *Am. J. Public Health.* 1998;88(7):1037-1041.
96. Lynch WD, Golaszewski TJ, Clearie AF, Snow D, Vickery DM. Impact of a facility-based corporate fitness program on the number of absences from work due to illness. *Journal of occupational medicine.: official publication of the Industrial Medical Association.* 1990;32(1):9.
97. Knight KK, Goetzel RZ, Fielding JE, et al. An evaluation of Duke University's LIVE FOR LIFE health promotion program on changes in worker absenteeism. *J. Occup. Med.* May 1994;36(5):533-536.
98. Jeffery RW, Forster JL, Dunn BV, French SA, McGovern PG, Lando HA. Effects of work-site health promotion on illness-related absenteeism. *J. Occup. Environ. Med.* 1993;35(11):1142.
99. Hodges LC, Harper TS, Hall-Barrow J, Tatom ID. Reducing overall health care costs for a city municipality: a real life community based learning model. *AAOHN journal: official journal of the American Association of Occupational Health Nurses.* 2004;52(6):247.
100. Hall-Barrow J, Hodges L, Brown P. A collaborative model for employee health and nursing education. Successful program. *AAOHN journal: official journal of the American Association of Occupational Health Nurses.* 2001;49(9):429.

101. Goetzel RZ, Dunn RL, Ozminkowski RJ, Satin K, Whitehead D, Cahill K. Differences between descriptive and multivariate estimates of the impact of Chevron Corporation's Health Quest program on medical expenditures. *J. Occup. Environ. Med.* 1998;40(6):538.

102. Dalton BA, Harris JS. A comprehensive approach to corporate health management. *J. Occup. Environ. Med.* 1991;33(3):338.

103. Edington DW, Yen LT, Witting P. The financial impact of changes in personal health practices. *J. Occup. Environ. Med.* 1997;39(11):1037-1046.

104. Conrad KM, Riedel J, Gibbs J. Effect of worksite health promotion programs on employee absenteeism. A comparative analysis. *AAOHN journal: official journal of the American Association of Occupational Health Nurses.* 1990;38(12):573.

105. Cady Jr LD, Thomas PC, Karwasky RJ. Program for increasing health and physical fitness of fire fighters. *J. Occup. Environ. Med.* 1985;27(2):110.

106. Bertera RL. Behavioral risk factor and illness day changes with workplace health promotion: two-year results. *Am. J. Health Promot.* May-Jun 1993;7(5):365-373.

107.Baun WB, Bernacki EJ, Tsai SP. A preliminary investigation: effect of a corporate fitness program on absenteeism and health care cost. *J. Occup. Med.* Jan 1986;28(1):18-22.

108. Anderzén I, Arnetz BB. The impact of a prospective survey-based workplace intervention program on employee health, biologic stress markers, and organizational productivity. *J. Occup. Environ. Med.* 2005;47(7):671.

109. Trudeau JV, Deitz DK, Cook RF. Utilization and cost of behavioral health services: employee characteristics and workplace health promotion. *The Journal of Behavioral Health Services and Research.* 2002;29(1):61-74.

110. Bly JL, Jones RC, Richardson JE. Impact of worksite health promotion on health care costs and utilization. Evaluation of Johnson & Johnson's Live for Life program. *JAMA.* Dec 19 1986;256(23):3235-3240.

111. Blair SN, Smith M, Collingwood TR, Reynolds R, Prentice MC, Sterling CL. Health promotion for educators: impact on absenteeism. *Prev. Med.* Mar 1986;15(2):166-175.

112. Goetzel RZ, Jacobson BH, Aldana SG, Vardell K, Yee L. Health care costs of worksite health promotion participants and non-participants. *J. Occup. Environ. Med.* 1998;40(4):341.

113. Henritze J, Brammell HL, McGloin J. LIFECHECK: A successful, low touch, low tech, in-plant, cardiovascular disease risk identification and modification program. *Am. J. Health Promot.* 1992;7(2):129-136.

114. Jones RC, Bly JL, Richardson JE. A study of a work site health promotion program and absenteeism. *J. Occup. Med.* Feb 1990;32(2):95-99.

115. Sciacca J, Seehafer R, Reed R, Mulvancy D. The impact of participation in health promotion on medical costs: A reconsideration of the Blue Cross and Blue Shield of Indiana study. *Am. J. Health Promot.* 1993;7(5):374-383+395.

116. Serxner SA, Gold DB, Grossmeier JJ, Anderson DR. The relationship between

health promotion program participation and medical costs: a dose response. *J. Occup. Environ. Med.* Nov 2003;45(11):1196-1200.

117. Stave GM, Muchmore L, Gardner H. Quantifiable impact of the contract for health and wellness: health behaviors, health care costs, disability, and workers' compensation (Provisional abstract). *J. Occup. Environ. Med.* 2003(2):109-117. http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-22003000418/frame.html.

118. Bunting BA, Cranor CW. The Asheville Project: long-term clinical, humanistic, and economic outcomes of a community-based medication therapy management program for asthma (Provisional abstract). *Journal of the American Pharmacists Association.* 2006(2):133-147. http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-22007000163/frame.html.

119. Page MJ, Paramore LC, Doshi D, Rupnow MFT. Evaluation of resource utilization and cost burden before and after an employer-based migraine education program. *J. Occup. Environ. Med.* 2009;51(2):213-220.

120. Hughes MC, Girolami TM, Cheadle AD, Harris JR, Patrick DL. A lifestyle-based weight management program delivered to employees: examination of health and economic outcomes (Structured abstract). *J. Occup. Environ. Med.* 2007(11):1212-1217. http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-22007006751/frame.html.

121. Bureau of Labor Statistics. *Employer Costs for Employer Compensation Summary.* Washington DC: Bureau of Labor Statistics;2009.

122. Nixon J, Stoykova B, Glanville J, Christie J, Drummond M, Kleijnen J. The U.K. NHS economic evaluation database. Economic issues in evaluations of health technology. *Int. J. Technol. Assess. Health Care.* Summer 2000;16(3):731-742.

123. Zarnke KB, Levine MA, O'Brien BJ. Cost-benefit analyses in the health-care literature: don't judge a study by its label. *J. Clin. Epidemiol.* Jul 1997;50(7):813-822.

124. Department of Business Innovation and Skills. *Small and Medium-sized Enterprise (SME) Statistics for the UK and Regions 2009.* London, UK: Government of the United Kingdom2010.

125. Australian Bureau of Statistics. *Counts of Australian Businesses, Including Entries and Exits, June 2007 until June 2011 (Cat. No. 8165.0).* Canberra, ACT: ABS2012.

126. Divine R. Determinants of Small Business Interest in Offering a Wellness Program to Their Employees. *Health Mark. Q.* 2005;22(3):43-58.

127. O'Donnell MP. What is the ROI of workplace health promotion? The answer just got simpler by making the question more complicated. *Am. J. Health Promot.* 2014;28(6):iv-v.

128. Goetzel R. Financial Impact of Workplace Health Promotion: 2015 Update. Paper presented at: 25th Annual Art and Science of Health Promotion Conference, San Diego, California, April 2. 2015.

129. O'Donnell MP. What Is the ROI for Workplace Health Promotion? It Really Does

Depend, and That's the Point. *Am. J. Health Promot.* 2015;29(3):v-viii.

130. Goetzel R. Don't Throw Out the Baby with the Bathwater - A Measured Response to Critics of Workplace Health Promotion and Disease Prevention Programs. Health Enhancement Research Organization (HERO) Webinar, April 22. Available at http://hero-health.org/events/ Accessed on May 2015.

131. Fonarow GC, Calitz C, Arena R, et al. Workplace Wellness Recognition for Optimizing Workplace Health A Presidential Advisory From the American Heart Association. *Circulation.* 2015;131(20):e480-e497.

Appendix 2A Publication of "The Relationship between Return on Investment and Quality of Study Methodology in Workplace Health Promotion Programs"

Baxter S, Sanderson K, Venn AJ, Blizzard CL, Palmer AJ. "The Relationship Between Return on Investment and Quality of Study Methodology in Workplace Health Promotion Programs." *American Journal of Health Promotion* July 2014; 28(6): 347-363

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"The final publication is available at ajhpcontents.org"

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Appendix 2B. Criteria for quality checklists used in sensitivity analysis of British Medical Journal Economic Evaluation Working Party (BMJ checklist)

Appendix 2B 1 Criteria found in Consensus on Health Economic Criteria: Chec-List [14] (CHEC-List) (2005)

1. Is the study population clearly described?
2. Are competing alternatives clearly described?
3. Is a well-defined research question posed in answerable form?
4. Is the economic study design appropriate to the stated objective?
5. Is the chosen time horizon appropriate to include relevant costs and consequences?
6. Is the actual perspective chosen appropriate?
7. Are all important and relevant costs for each alternative identified?
8. Are all costs measured appropriately in physical units?
9. Are costs valued appropriately?
10. Are all important and relevant outcomes for each alternative identified?
11. Are all outcomes measured appropriately?
12. Are outcomes valued appropriately?
13. Is an incremental analysis of costs and outcomes of alternatives performed?
14. Are all future costs and outcomes discounted appropriately?
15. Are all important variables, whose values are uncertain, appropriately subjected to sensitivity analysis?
16. Do the conclusions follow from the data reported?
17. Does the study discuss the generalizability of the results to other settings and patient/client groups?
18. Does the article indicate that there is no potential conflict of interest of study researcher(s) and funder(s)?
19. Are ethical and distributional issues discussed appropriately?

Evers, S., et al. (2005). "Criteria list for assessment of methodological quality of economic evaluations: Consensus on Health Economic Criteria." *International Journal of Technology Assessment in Health Care* 21(2): 240-245.

Appendix 2B 2 Criteria found in NICE Study Limitations (2010)

1 Does the model structure adequately reflect the nature of the health conditon under evaluation?
2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?
3 Are all important and relevant health outcomes included?
4 Are the estimates of baseline health outcomes from the best available source?
5 Are the estimates of relative treatment effects from the best available source?
6 Are all important and relevant costs included?
7 Are the estimates of resource use from the best available source?
8 Are the unit costs of resources from the best available source?
9 Is an appropriate incremental analysis presented or can it be calculated from the data?
10 Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?
11 Is there no potential conflict of interest?
12 Overall Assessment: Minor limitations/Potentially serious limitations/Very serious limitations

Shemilt I, M. M., Vale L, Marsh K, Donaldson C (editors) (2010). Evidence-based decisions and economics : health care, social welfare, education and criminal justice. 2nd ed. Chichester, West Sussex, UK ; Hoboken, NJ, Wiley-Blackwell/BMJ Books.

Appendix 2C Supplementary Tables and Figures

Below is a table of the search results broken down into the yield of studies from the long search and the MESH search.

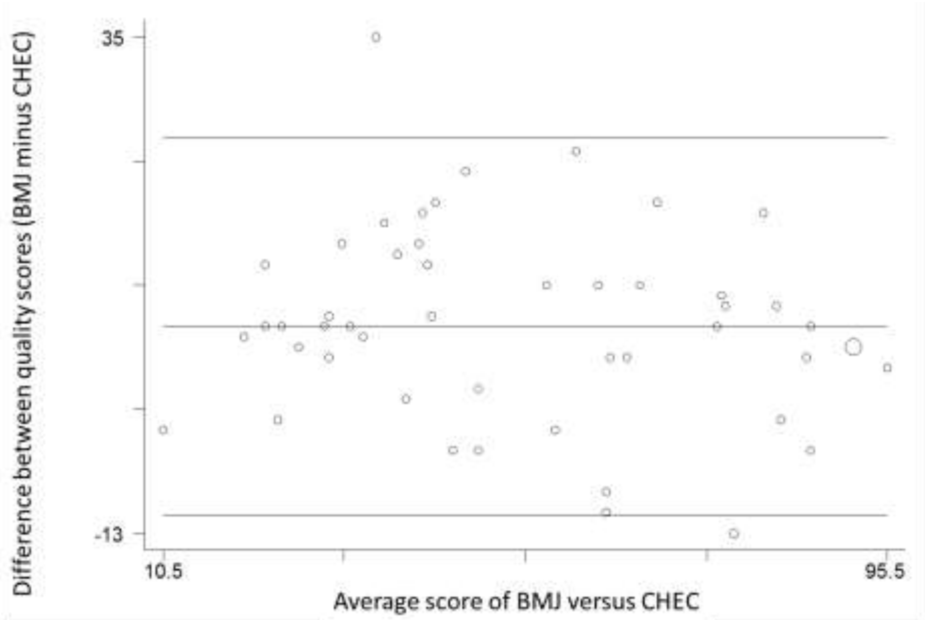
Appendix 2C 1 Combined summary of yield from search results (long and MESH search)

Database	**Long Search**	**MESH Search**	**Total**
NHS EED	504	116	620
DARE	107	13	120
HTA	26	7	33
PUBMED MEDLINE	NP	79	79
EconLit	439	79	518
Scopus	1122	216	1338
Embase	953	208	1161
CEA Registry	4	NP	4
Total	3188	718	3906
Total studies		**3906**	
From economic databases		1295	
From biomedical databases		2611	

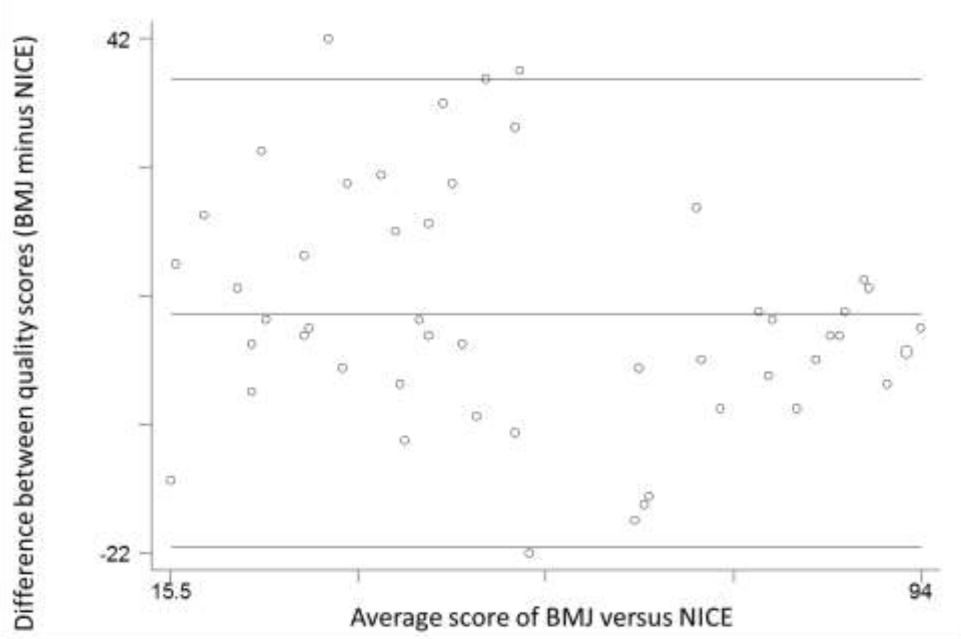
NP = Not performed, yield was too large for long search in PubMed and too small for MESH terms in CEA Registry.

Economic databases include: NHS EED (National Health Service Economic Evaluation Database); DARE (Database of Abstracts of Reviews of Effects); HTA (Health Technology Assessment Database); Econlit (American Economic Association); CEA Registry (Cost Effectiveness Analysis Registry)

Bland Altman plots [86] were used to check systematic patterns in differences between the BMJ checklist and the CHEC –List and NICE Study Limitations quality scores



Appendix 2C 2 Data from quality scores plotted to show the difference in scores between BMJ and CHEC-List against the average score



Appendix 2C 3 Data from quality scores plotted to show the difference in scores between BMJ and NICE Study Limitations against the average score

Below is the mean number of 'yes' 'no' and 'not applicable' scores for all studies.

Appendix 2C 4 Mean response per individual quality question of the 36-item BMJ checklist[23]

Quality Questions	Mean number of answers			Mean percentage mark for 'yes'		
	Yes	No	NA	Overall Score	Studies pre 2000 (n=24)	Studies post 2000 (n=28)
1. Was the research question stated?	45	7	0	87%	83%	89%
2. Was the economic importance of the research question stated?	44	8	0	85%	75%	93%
3. Was/were the viewpoint(s) of the analysis clearly stated and justified?	21	31	0	40%	21%	57%
4. Was a rationale reported for the choice of the alternative programmes or interventions compared?	37	15	0	71%	58%	82%
5. Were the alternatives being compared clearly described?	35	17	0	67%	54%	79%
6. Was the form of economic evaluation stated?	38	14	0	73%	71%	75%
7. Was the choice of form of economic evaluation justified in relation to the questions addressed?	23	29	0	44%	29%	57%
8. Was/were the source(s) of effectiveness estimates used stated?	31	9	12	78%	68%	86%
9. Were details of the design and results of the effectiveness study given (if based on a single study)?	34	7	11	83%	80%	86%
10. Were details of the methods of synthesis or meta-analysis of estimates given (if based on an overview of a number of effectiveness studies)?	0	0	52	NA	NA	NA
11. Were the primary outcome measure(s) for the economic evaluation clearly stated?	39	13	0	75%	71%	79%
12. Were the methods used to value health states and other benefits stated? Time tradeoff, standard gamble, contingent valuation(CEA) human capital WTP (CBA)	27	24	0	53%	42%	63%
13. Were the details of the subjects from whom valuations were obtained given?	29	23	0	56%	38%	71%
14. Were productivity changes (if included) reported separately?	30	20	2	60%	48%	70%
15. Was the relevance of productivity changes to the study question discussed?	35	17	0	67%	54%	79%
16. Were quantities of resources reported separately from their unit cost?	16	36	0	31%	17%	43%
17. Were the methods for the estimation of quantities and unit costs described?	35	17	0	67%	50%	82%
18. Were currency and price data recorded?	49	3	0	94%	100%	89%
19. Were details of price adjustments for inflation or currency conversion given?	24	27	1	47%	46%	48%
20. Were details of any model used given?	7	2	43	78%	50%	86%
21. Was there a justification for the choice of model used and the key parameters on which it was based?	7	2	43	78%	50%	86%
22. Was time horizon of cost and benefits stated?	46	6	0	88%	92%	86%
23. Was the discount rate stated?	10	23	19	30%	17%	47%
24. Was the choice of rate justified? if Q23= NA Q24= NA, if Q23 = 0 Q24 =0	5	28	19	15%	11%	20%
25. Was an explanation given if cost or benefits were not discounted?	2	40	10	5%	5%	5%
26. Were the details of statistical test(s) and confidence intervals given for stochastic data?	19	33	0	37%	13%	57%

27. Was the approach to sensitivity analysis described? (multivarate, univariate, threshold analysis)...NA if actual company/claims	14	38	0	27%	8%	43%
28. Was the choice of variables for sensitivity analysis justified?	14	37	1	27%	9%	43%
29. Were the ranges over which the parameters were varied stated?	16	35	1	31%	17%	43%
30. Were relevant alternatives compared? (i.e. Were appropriate comparisons made when conducting the incremental analysis?)	43	9	0	83%	71%	93%
31. Was an incremental analysis reported? Difference calculation	33	18	0	65%	58%	70%
32. Were major outcomes presented in a disaggregated as well as aggregated form?	27	24	0	53%	38%	67%
33. Was the answer to the study question given?	39	13	0	75%	63%	86%
34. Did conclusions follow from the data reported?	26	26	0	50%	29%	68%
35. Were conclusions accompanied by the appropriate caveats?	34	18	0	65%	58%	71%
36. Were generalisability issues addressed?	14	38	0	27%	21%	32%
TOTAL "YES"				948	356	592
TOTAL "NO"				707	413	294
TOTAL "NA"				214	95	119
TOTAL OVERAL SCORE				57%	46%	67%

NA = 'Not applicable'

Below is the BMJ quality scores for each paper, showing the breakdown for study design, data collection and analysis and interpretation. The overall score has been listed in order of highest to lowest

Appendix 2C 5 BMJ scores for individual papers included in the review

Author	Year	Origin	Study Design	Data Collection	Analysis and Interpretation	**Overall score**
Groeneveld [66]	2011	Netherlands	100%	100%	92%	**97%**
Samad [54]	2006	Maylasia	86%	100%	92%	**94%**
Colombo [52]	2006	Italy	100%	91%	92%	**94%**
At'kov [42]	2011	Russia	100%	92%	92%	**94%**
Bridges [51]	2001	USA	86%	100%	92%	**94%**
Cohen [41]	2003	Australia	100%	91%	85%	**90%**
Proper [68]	2004	Netherlands	100%	82%	92%	**90%**
Meenan [67]	2010	USA	100%	100%	71%	**88%**
McEachan [39]	2011	UK	100%	73%	92%	**87%**
Morales [55]	2004	Columbia	100%	91%	69%	**84%**
Greene [65]	2009	USA	86%	92%	71%	**82%**
Naydeck [78]	2008	USA	86%	73%	86%	**81%**
Campbell [50]	1997	USA	86%	82%	77%	**81%**
Taimela [69]	2008	Finland	86%	85%	69%	**79%**
Shi [35]	1993	USA	86%	90%	67%	**78%**
Ichihashi [48]	2007	Japan	86%	73%	64%	**72%**
Schneider [57]	2011	Germany	100%	70%	57%	**71%**
Goetzel [63]	2005	USA	86%	77%	57%	**71%**
Ozminkowski [36]	1999	USA	86%	44%	71%	**67%**
Baker [38]	2008	USA	86%	69%	54%	**67%**
Dille [53]	1999	USA	57%	91%	46%	**65%**
Mills [61]	2007	UK	57%	73%	54%	**61%**
Bertera [49]	1990	USA	57%	89%	40%	**58%**
Schrammel [58]	1998	USA	43%	77%	47%	**57%**
Nyman [34]	2012	USA	57%	67%	50%	**57%**
Kumpulainen [57]	1997	Finland	71%	82%	27%	**55%**
Aldana [76]	1993	USA	71%	80%	27%	**53%**
Schwartz [33]	2010	USA	57%	64%	38%	**52%**
Golaszewski [64]	1992	USA	57%	62%	36%	**50%**
Foote [84]	1991	USA	71%	36%	47%	**48%**
Wood [44]	1989	USA	57%	55%	40%	**48%**
Aldana [47]	2005	USA	43%	89%	27%	**48%**
Henke [37]	2011	USA	71%	62%	20%	**46%**
Yen [75]	2010	USA	57%	55%	33%	**45%**
Gibbs [43]	1985	USA	43%	50%	43%	**45%**
Merrill [80]	2011	USA	57%	22%	53%	**45%**
Bowne [70]	1984	USA	43%	55%	33%	**42%**

Bertera [81]	1990	USA	71%	45%	20%	**39%**
Milani [45]	2009	USA	57%	55%	20%	**39%**
AHA [62]	1987	USA	57%	40%	23%	**37%**
Gettman [77]	1986	USA	43%	36%	33%	**36%**
Leutzinger [72]	1995	USA	43%	46%	20%	**34%**
Windsor [74]	1989	USA	57%	36%	20%	**33%**
Shore [59]	1989	Canada	57%	36%	15%	**32%**
Shephard [60]	1992	Canada	43%	36%	15%	**29%**
Schultz [73]	2002	USA	29%	33%	27%	**29%**
Tao [46]	2009	USA	57%	30%	13%	**28%**
Harris [79]	1986	USA	14%	36%	23%	**26%**
Harvey [83]	1993	USA	43%	22%	13%	**23%**
Serxner [82]	1993	USA	29%	36%	8%	**23%**
Davis [71]	2009	USA	0%	18%	7%	**9%**

3 Chapter three: Development of the Workplace Health Savings Calculator; a WHP business case resource

3.1 Preface

The preceding Chapter investigated the global evidence concerned primarily with the state of the methodological quality of economic evaluations in workplace health promotion. Further, an expected return on investment (ROI) and significant correlates of this economic outcome were calculated.

The work in Chapter 3 was performed from a local Tasmanian perspective and represents an outcome from *partnering*Healthy@Work. It is the result of a research-policy student internship within the Tasmanian Government Department of Health and Human Services (November 2011-February 2012), and investigated a partner-directed research question: **How to make sense of the evidence in order to develop appropriate resources for business engagement?** Resource development was considered within the Healthy@Work project as demonstrating leadership in the state's workplace health and wellbeing arena.[1] The aim of the internship was to 1) write a business justification chapter for a government-published "Healthy Workplace Resource Toolkit" (the 'Toolkit'), designed to support Tasmanian organisations (including the Tasmanian State Service) when they develop and implement WHP; and 2) develop a simple tool to calculate economic impact associated with WHP.

Aim 1, the business justification chapter titled "How will a health and wellbeing program improve my bottom line?" is shown in Appendix 3A. The original paper-based version of the simple tool (Aim 2) titled "How can I calculate the financial benefit to my organization?" appears in Appendix 3B and Appendix 3C. The Toolkit was piloted by Tasmanian businesses to gauge its utility. A brief comment on its utility can be found in this Chapter's postscript.

The following Chapter describes the methods used to address aim 2 and the subsequent development of the Workplace Health Savings Calculator that was further accepted by the Australian government as a workplace health promotion resource. This work is an example of translational research through partnership. This manuscript is published in *BMC Research Notes – Technical Note* (Appendix 3D) and titled:

> **Baxter S**, Campbell S, Sanderson K, Cazaly C, Venn AJ, Owen C, Palmer AJ. "Development of the Workplace Health Savings Calculator: a Practical Tool to Measure Economic Impact from Reduced Absenteeism and Staff Turnover in Workplace Health Promotion." *BMC Research Notes – Technical Note* (2015) 8:457

3.2 Background

Improving the health and wellbeing of workers is firmly on the public health and business agenda. The World Health Organization (WHO) has identified the workplace as a target setting for health promotion,[2] and formed a Global Plan of Action on Workers' Health (2008-2017)[3] to protect and promote health at work and respond to the health needs of the working population. Endorsement of this action plan is evidenced in the emergent company and society-wide shift to include workplace health promotion as a key strategy. Consequently, workplace health has gained profile as a strategic asset to economies, as revealed in various international reports and policy guidelines.[4-10] This stands, despite recent inconclusive reviews on whether health and economic outcomes are positive, negative or neutral,[11-14] and an extensive review that demonstrated economic evidence, although improving over time, is low to moderate in methodological quality.[15] Nonetheless, the evidence that healthy employees provide social and economic benefits to businesses and the community continues to be largely accepted. These include reductions in absenteeism from illness and injury, increased productivity, reduced staff turnover, reduction in health care costs and a more satisfied work force.[15-18]

Health economics offers an analytical technique to measure the financial impact of health-promoting initiatives in order to assess allocation efficiency and determine whether or not an intervention is worthwhile. Although it is important for government, organisations and businesses to accurately measure the rate of return on investments, the application of health economic theory in workplace health is steeped in methodological complexities.[15] Primarily, economic evaluations focus on indicators of business performance and health change targets. Although tools such as workplace health calculators are available for decision makers who wish to create a business case for workplace health, those that currently exist online have been developed from evidence arising out of the Unites States and the United Kingdom with financial estimates available in British pound[19,20] and United States dollar,[21] and the latter only suitable to businesses with greater than 1000 employees based in US, Europe, India and China. Little is available to assist other jurisdictions in the business case for workplace health, both in terms of currency output and simple translation, and as a result, the adoption of these existing online-calculators can be problematic.

In 2009 the Australian Government established the National Partnership Agreement on Preventive Health initially promising an investment of $221.8 million over nine years (2009-10 to 2017-18).[9] This committment provided funding to all states and territories to support the Healthy Workers Initiative and enabled Australian health policy-makers to engage in a common mission to improve and maintain the health and wellbeing of workers. With this support, a Healthy Workers Initiative project team was developed within Population Health Services in the Tasmanian Department of Health and Human Services. One of the many objectives of the project team was to develop an evidence-based, simple and easy-to-use resource (calculator) for Australian employers interested in workplace health investment figures, and make this available through the Healthy Workplace Resource Toolkit.

This paper describes the development of the Workplace Health Savings Calculator, a toolkit output that is currently available online.

3.3 Methods

3.3.1 Data collection

Data were collected in three phases (i) locate appropriate effectiveness measures, (ii) identify change estimates surrounding these measures and (iii) decide on an appropriate model.

To satisfy the first phase, a literature review was being performed by SB, AP, KS and AV (the researchers) at the time the Healthy Worker Initiative project team members SC and CO approached with the question “What is the evidence-based business case for workplace health promotion?” A partnership agreement was established and researchers utilised their concurrent literature search for the purposes of providing economic evidence to assist the development of the Healthy Workplace Resource Toolkit. The search was conducted in relevant economic and biomedical databases between November 2011 and January 2012. In addition, a keyword search using Google Scholar and a manual search of citations from relevant papers was undertaken to locate published evidence on the financial impact of workplace health promotion. The search strategy has been published along with the review.[15] Information gained from this review was utilised to ascertain measures of effectiveness which contextually provided transferability and generalisability to the Australian sector. Two measures of effectiveness were recognised as business metrics most readily captured in operations. These were worker ‘absenteeism’ and ‘staff turnover.’ Both were adopted as the key performance estimates for the calculator.

The second requirement in the development phase was to establish the magnitude of possible change in absenteeism and staff turnover as a result of implementing a workplace health program. These estimates of change for absenteeism and staff turnover were sourced from a second review study[22] which readers can refer to for additional information. This review, published in 2008, was commissioned by the Health Work Wellbeing Executive in England and undertaken by PriceWaterhouseCoopers LLP. Under the constraints identified in the first review, namely, that no Australian equivalent published data source existed, that volume of publications from the United States of America far exceeded that from jurisdictions operating under a national health care system, and that large variability in both estimates and methodological quality of studies prevail, the authors considered this

PriceWaterhouseCoopers' review to be most appropriate for our needs and of sound evidence base. Moreover, the evidence from this review is cited and supports the Workplace Wellbeing Charter,[7] a national award, whose "standards reflect best practice" and is endorsed by Public Health England.

Finally, an internet search was conducted to locate workplace health calculators currently in existence. These were assessed for their ease of use and applicability to the Australian business context. As a result of this search, a model developed by the National Institute for Health and Clinical Excellence (NICE)[20] was considered simple to use and adapted for our purposes.

3.3.2 Assumptions used to develop the tool

In developing the tool, the following assumptions were made. First, 'absenteeism' (or 'sick leave') was defined as an employee's unplanned leave from work, not including other leave such as carer's leave or maternity leave. Examples of unplanned leave would be due to illnesses such as colds and flu.

Second, a workplace health promotion program was considered 'successful' when it was designed to target the needs of employees, when participation rates were reasonable (greater than 25% participation), and the program was actively supported by senior management and leaders within the organisation.

Third, different types of workplace health promotion interventions (health and safety, disease management, and health promotion – the modification of risk behaviours such as smoking, nutrition, physical activity and stress to improve overall employee wellbeing) contributed equally, and were linked to the improvement of the effectiveness estimates.

Last, calculated savings were assumed to be a long-term benefit. It is evidenced in the literature that positive effects on absenteeism and staff turnover occur between two and five years post implementation of a successful workplace health program.[23]

3.4 Results

The PriceWaterhouseCoopers' review,[22] from which the magnitude of change for absenteeism and staff turnover was sourced, included 55 case studies from organisations in the United Kingdom that implemented a variety of workplace health promotion programs. The case studies were submitted to the Health Work Wellbeing Executive and PricewaterhouseCoopers LLP was commissioned to undertake a review including interviews with selected organisations. Overall, 45 case studies reported evidence on change related to absenteeism and 18 on staff turnover, with 28 (51%) providing evidence from behaviour modification or lifestyle programs such as smoking cessation, healthy diet and subsidised exercise programmes. These interventions focussed on similar behavioural and lifestyle health risk change targets to those encouraged in Australia, which are commonly referred to as SNAPS (smoking, nutrition, alcohol, physical activity, stress) interventions.[24] There were 32 case studies (58%) focussed on occupational health and safety interventions. The data was collected from businesses within nine different industries; defined as manufacturing, finance, public service, utilities, business services, construction/engineering, retail, education, and others. Company size and intervention type by industry group for all case studies is provided in the source review.[22] Their diversity represented a good range of industry types relevant to Australia, with national statistics identifying the vast majority of Australian businesses operate in the service sectors (construction, professional/scientific/technical, retail trade, education, accommodation, transport, and utilities), with the remaining in manufacturing, mining agriculture/forestry and fishing.[25] Further similarities between these two nations such as the proportion of small to medium businesses, population demographics and drivers for workplace health promotion are shown in Table 3.1.

Global trends in employer wellbeing strategies and practices were reported in 2014.[26] Data were collected from 37 countries (in 11 languages) that included 1041 employer-participants (8 million employees) across all industry categories. Although it documented similarities between Australia/New Zealand and Europe in terms of percentages of organisations offering health promotion, health risk drivers (namely stress, physical activity, nutrition), and types of program components, no evidence relating to differences in effect size between countries was obtained. There is paucity in the literature surrounding between-country magnitudes of effect in workplace health promotion. Consequently, within the calculator, functionality allows change estimates for absenteeism and staff turnover to be edited by the user, and the default figure represents the lowest effectiveness estimate from the range reported in the UK PricewaterhouseCoopers' review. Refer to Table 3.2 for change estimates and ranges. This most conservative approach acknowledges that these benefits may not be fully transferable to the Australian context.

When an average effectiveness estimate was reported, it was assumed the average was an average across the case studies that measured that particular effectiveness outcome. It was therefore presumed the average would apply for any business that measured these particular outcomes after implementation of a workplace health promotion program.

In concluding the assumptions used to develop the Workplace Health Savings Calculator, this tool is considered by the authors to be most appropriate for use in Australia, on the following basis; 1) input estimates for absenteeism and staff turnover are generated by the Australian user company, 2) cost estimates are derived using Australian wage statistics, and

3) change estimates from the PriceWaterhouseCoopers' review are a) most conservative and b) generalizable to the Australian business context. The Workplace Health Savings Calculator specifically does not attempt to measure or quantify in dollar value any additional health benefits that may be enjoyed by employees undertaking health promotion in their workplace; as such estimates remain elusive in the literature.[15]

3.4.1 Description of user interface

The calculator was adapted from a model developed by the National Institute for Health and Care Excellence (NICE),[20] and consists of three tabs (Figure 3.1). The first allows the user to input relevant data on employee numbers and salary, the second to input data on staff turnover, and the third tab calculates the total potential annual savings that arise from the implementation of a successful workplace health promotion program. Below the savings output on this third and final tab is an organisational profile box which users have the option to complete and submit (Figure 3.2). The submitting user maintains anonymity of the company name yet provides the site administrator with base level information about the company, such as industry type, business size and locality. Lastly, for users who wish to identify themselves, there is an option at the bottom of the box to submit an email via a 'Contact us' hyperlink.

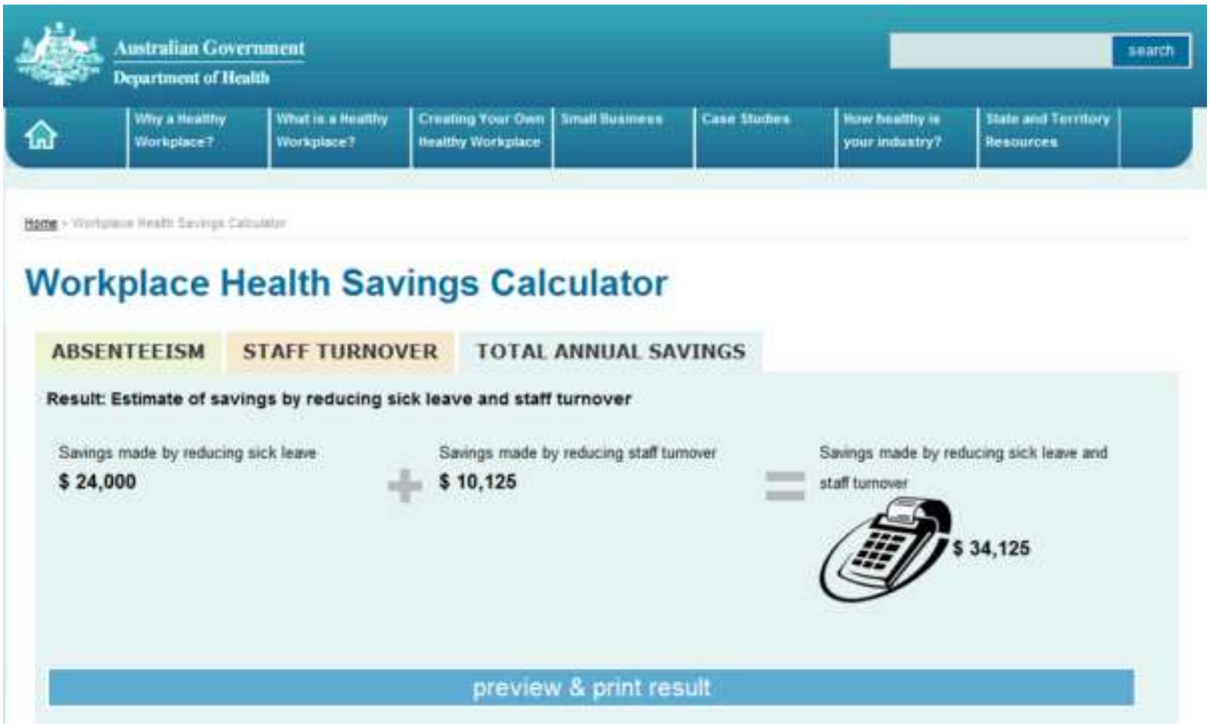


Figure 3.1 Workplace Health Savings Calculator as it appears on the Commonwealth Government's Department of Health, Healthy Workers web portal

The example calculation presented in Figure 3.1 is for a company profile whose input would match the following scenario.

In the last 12 months, Company 'eX' of 100 employees has experienced a sick leave rate of 4 days per employee (total annual sick days 400) and has recruited 3 replacement staff. The average staff salary is $45,000. The company operates 8 hours a day and the average hourly wage is $25. The estimated potential savings to the company when implementing a successful workplace health and wellbeing program is set at the default effectiveness measures; a 30% reduction in sick leave and a 10% reduction in staff turnover. The cost of replacing an employee is defaulted at 75% of the annual salary.

Figure 3.2 Screen that accompanies the Workplace Health Savings Calculator for purposes of data collection. The data is non-identifiable unless users wish to identify themselves by submitting an email via the 'Contact us' hyperlink option at the bottom of this organisational profile box.

For companies whose staffing profile does not solely consist of full-time employees, an additional feature was added to account for part-time and casual positions. For these businesses, where total number of full-time equivalent hours may not be recorded, there is an option within the calculator that allows the user to input 'total number of sick days in the last 12 months' instead of 'total number of employees'. This feature simplifies the data gathering process, and allows users to choose between two algorithms in order to estimate, with minimal burden, the total annual savings in sick leave achievable by implementing a successful workplace health and wellbeing program.

Tabs one and two use effectiveness estimates to derive savings that arise from reduced absenteeism and staff turnover, which is defaulted to the most conservative estimates and can be overridden by the user. It was envisioned that the default estimates may be overridden by companies that are already implementing a program for which company-specific evaluation data were available, and for whom an online-generated calculation of annual savings offered some utility.

The effectiveness estimates within the calculator are sourced from the PriceWaterhouseCoopers' review[22] and Australian wage statistics.[27] These were absenteeism rates, which reduce by an average of 30-40%;[22] staff turnover rates, which decrease by 10-25%;[22] and replacement cost due to staff turnover, which ranged from 75%-150% of the worker's wage.[27] There were many and various costs associated with this measure, such as costs for recruitment, training, specialist knowledge and productivity[28] which could account for the large range that was reported. In line with agreed assumptions, the most conservative estimates were used in the model when a range of estimates were offered. Details of these change estimates used and generalisability are provided in Table 3.1 and Table 3.2.

Table 3.1 Generalisability of the source review[a]

Parameters	Australia	United Kingdom (UK)	Comments/Assumptions
SME proportion	99.7% [29]	99.9% [30,31]	UK effectiveness estimates in report derived from similarly high proportion of SMEs to Australia *
Industry types	85 per cent of SMEs operate in the service sectors (construction (14%), professional/scientific and technical (12%), retail trade (10%) and others including education, accommodation, transport, utilities), with the remaining in agriculture/forestry and fishing (8%), manufacturing (6%) and mining (1%) [25]	Data from 9 industries: manufacturing, finance, public service, utilities, business services, construction/engineering, retail, education, others[22]	Good range of industry types relevant to Australian industry. Construction industry reported effectiveness for occupational health and safety (OH&S) interventions only.
Aging population	In 2005, median age 36.6 years [32] By 2050, median age 45 [33] 1 in 4 Australians aged 65 years or over by 2056 [34]	In 2005 median age 39 years[32] By 2050, median age 43[33] Between 1971-2006, those aged 65 years increased by 31% [22]	Similar population aging demographics
Aging workforce	By 2050, 26% over 65 years [35]	By 2024, 50% over 50 years [36] By 2050, 24% in UK over 65 years [35]	Similar workforce demographics
Drivers	Human capital**, government initiative, OH&S [37]	Government, social responsibility, rising cost of human capital[22]	Similar implementation drivers

Intervention targets	SNAPS (ie: smoking, nutrition, alcohol, physical activity, stress) behavioural and lifestyle health risks [24]	51% (28/55) lifestyle (i.e.: smoking cessation, healthy diet and subsidised exercise programmes) 58% (32/55) OH&S [22]	Lifestyle interventions focus on similar behaviour change targets to those encouraged in Australia and are also those most commonly seen in research of behaviour modification health interventions in the workplace.

[a] PricewaterhouseCoopers LLP was commissioned by the Health Work Wellbeing Executive to undertake a review of the business case for workplace health, which included a review of 55 case studies from United Kingdom organisations[22]

*** There were seven SMEs (small-to-medium enterprise) of the 55 case studies in the source report; two measured absenteeism, one measured staff retention, three measured both absenteeism and staff retention, and one measured absenteeism (from OH&S interventions only). In their reported benefits, all SMEs saw decreased absenteeism and improved retention.**

**** Human capital: drivers include talent attraction, retention and ideas of broader corporate social responsibility. This approach also seeks to improve productivity and reduce workforce absenteeism[37]**

Table 3.2 Change estimates used within the Workplace Health Savings Calculator[b]

Change estimate	Source	Measurement	Assumption
Absenteeism (% decrease)	PWC 2008 [22b]	Average 30%-40% reduction, based on 45/55 case studies	The other 10 studies did not measure the perceived benefits of AB, so average holds for all that do
Staff Turnover (replacement cost)	ABS 2008 [27]	75%-150% salary as replacement cost. Industry types: Engineering, Construction, Professional Services (e.g.: Finance, Admin), Public Service, Resources (e.g.: Agriculture, Mining) Retail and Entertainment	75% a conservative assumption used in place of conclusive evidence
Staff Turnover (% decrease)	PWC 2008 [22]	10-25% decrease in staff turnover, based on 18/55 case studies. On average this retention range was 20-25% (from 4 industry categories: finance, utilities, business service, and other)	That 37 case studies did not report on turnover, average based on the 18 studies that did. Average holds as an average for all

[b] These were extracted from the source review[22] of 55 case studies that had varying durations of

implementation. It has been shown in the literature that benefits from reduced absenteeism and staff turnover may not be realised before two-five years after implementation of a successful workplace health promotion program.[23] We wish to reiterate an assumption outlined in this study that the calculated potential annual savings is a long-term benefit.

The calculator was initially published in print within the Healthy Workplace Resource Toolkit (Appendix 3B) with an accompanying page offering an example of the algorithm (Appendix 3C). In 2013 a Microsoft Excel spreadsheet was developed and the calculator was published on the WorkSafe Tasmania website.[38]

The algorithm was later adapted and reproduced by the Australian Government Department of Health and Aging for use on the Healthy Workers web portal, as part of its official toolbox for the economic assessment of workplace health promotion programs. Titled "The Workplace Health Savings Calculator," it is available at: www.healthyworkers.gov.au on the home screen in the 'News' link (or via direct link: http://www.healthyworkers.gov.au/internet/hwi/publishing.nsf/Content/roi-introduction).

Since its national online publication, the tool has been endorsement by an Australian non-government organisation and commercial providers of workplace health promotion and their respective networks. Further adaptions of the calculator can be viewed online.[39,40] Evidence regarding its usability and further application are being collected through the organisational profile box and ongoing collaborator consultations. Initial data from the first year demonstrate the calculator has been accessed by a variety of businesses within the industries of Agriculture, Forestry & Fishing; Health and Community Services; Education; Government Administration and Defence; Retail; Electricity, Gas and Water; and Personal and Other Services. Data also indicate these businesses are located across every state and territory in Australia, and in both metropolitan and regional areas. Two international companies have also completed the organisational profile. The majority of organisations (88%) employed less than 200 workers of which 40% identified as small in size (1-19 employees). These initial statistics are encouraging, and not only demonstrate an interest in workplace health promotion from the Australian small-to-medium enterprise (SME) community but also across the entire country.

3.5 Discussion

The Workplace Health Savings Calculator is an online tool for estimating the economic impact of improved productivity from the implementation of a successful workplace health promotion program. It utilises a conservative set of assumptions to generate an estimate of potential annual savings. It calculates financial benefits related to reduced absenteeism and staff turnover using input estimates (number of employees, sick leave rates, average hours worked, average wage, number of resignations) that are generated at the individual company level. Annual turnover and number of employees are tangible key performance estimates most commonly measured in Australia.[25] The estimate for cost to replace staff is an Australian statistic.[27] Although commonly measured, there is a lack of Australian evidence on absenteeism and staff turnover in relation to workplace health promotion outcomes and the authors were required to carefully consider the vast and varying evidence on effectiveness and cost-effectiveness in the global literature. This was achieved in concurrence with a systematic review undertaken by the authors SB, AP, KS and AV.[15] It was considered that these two metrics (absenteeism and staff turnover) provided 1) the ease of measurement needed, and 2) best attainable estimates to attribute a dollar value, and thereby met our primary objective to develop an evidence-based, simple and easy-to-use resource (calculator) for Australian employers interested in workplace health investment figures.

Presenteeism, being present at work while suffering from a health problem that may limit job performance,[41] is also linked with negative impacts to productivity and associated costs. Indeed, presenteeism accounts for greater aggregate productivity loss than absenteeism,[42-44] thus decreasing worker presenteeism rates will lead to greater savings. Although preliminary evidence has shown that workplace health promotion may be effective at decreasing presenteeism rates,[45] there are critical issues surrounding the measurement, conversion and translation of value into economic outcomes.[46-48] It is not the intention of this calculator to overestimate outcomes or in the interest of sustainability of engagement for users to receive an inflated savings figure which may not be realised. For this reason, only business estimates from absenteeism and staff turnover were considered and the most conservative estimates were utilised when average ranges were reported.

The authors further acknowledge that estimating economic savings from productivity loss, even with the exclusion of a measure for presenteeism, remains debatable due to the wide variability, large influence on saving outputs, and issues surrounding use of indirect costs such as double counting and perspective.[49] Therefore the computed savings estimate from the Workplace Health Savings Calculator should not be considered to have utility in a health economic evaluation of workplace health promotion program. It is not an assessment or evaluation tool, rather an engagement tool to support workplace health and wellbeing efforts. The intended design and application is to engage businesses who are seeking an instrument to develop commitment at a stakeholder level.

Furthermore, the Workplace Health Savings Calculator is not a return on investment tool. It does not give the option to quantify program costs and therefore does not estimate net benefits or utilise cost benefit analysis techniques.

The United Kingdom PriceWaterhouseCoopers' review[22] was considered to have a strong methodological approach for the reported business outcomes, with its published effectiveness data also being used to support the Workplace Wellbeing Charter, National Award for England. The authors believe this review represented the best evidence base. In a field known to be lacking in robust quantifiable effectiveness and economic data, the authors recognise the lack of a more scientific approach compromises the validity of the calculator however consider the findings from the case studies to be real world representation and their use in this tool a pragmatic application.

Moreover, the NICE model from where the Workplace Health Savings Calculator was adapted is available as a business case tool within the NICE guidelines [PH13][20] for promoting physical activity at work. In December 2014 the guidelines underwent a second three-yearly review and the concluding decision states “no new evidence was identified which appeared to contradict the existing recommendations” p 8.[50] Reliability and validity are cornerstone principles to scientific method, and although a gross limitation to the calculator is the fact that neither has been tested, the continued and ongoing expert opinion accepts such limitations due in part to a lack of rigorous evaluation designs, and the complexities and heterogeneities surrounding this public health intervention.

In terms of generalisability, the research evidence used for change estimates was generated from an international (UK) context not an Australian setting where the calculator is applied. It is therefore unknown whether the effect size is transferable to locally-implemented interventions. However, we demonstrated that business sector statistics, workplace health strategies and practices, and the overarching political agenda focused on promoting health in the workplace to address rising prevalence of chronic disease is similar between both countries. Baseline prevalence, characteristics of the target population and capacity to implement interventions are key attributes for transferability in evidence-based public health.[51]

From the initial data on organisational profile collected by the online Workplace Health Savings Calculator there has been a large proportion of SME interest. Australia defines a SME as a business employing 0-199 workers (small represents 0-19 employees and medium represents 20-199 employees[25]), and SMEs make up 99.7% of the Australian business sector.[29] This is comparable in both proportion and definition to United Kingdom, where SMEs are “businesses with zero to 249 employees, (which) account for 99.9 per cent of all enterprises” p9. [30] Interestingly, of the 55 case studies in the source review, only seven (13%) were SMEs, representing manufacturing, financial, business services and retail sectors. The approximate size for all other organisations ranged from 200-100,000+, the largest being the public sector service organisation. The low representation by small-to-medium business in the review could indicate a general lack of engagement or lack of resources. Nevertheless, in jurisdictions and regions where the business profile differs, for example in Tasmania, Australia (where the vast majority of SMEs are small businesses (94.8%), with 58.8% being non-employing businesses and 36% employing 0-19 workers[29,52]), a declaration of company size from where estimates originated should be made within the calculator.

Workplace health promotion is a modern corporate strategy, and for countries like Australia, it is a recognised public health initiative aimed at improving employee health and wellbeing. Calculators to assist in business justification are needed to develop stakeholder commitment and are seen as suitable to engage business in conversation for promoting health in the workplace. Other currently available online calculators lack generalisability to the Australian business market. Limitations surround country specificity, currency, complexity and appropriate evidence transferability. In contrast, the Workplace Health Savings Calculator is a practical easy-to-use business case tool that was developed in line with one of the core principles of the National Partnership Agreement on Preventive Health, and is to be used to support, engage and promote the implementation of healthy lifestyle programs in Australian workplaces.

3.6 Availability and requirements

Project name: Workplace Health Savings Calculator

Project home page: www.healthyworkers.gov.au and direct link available at: http://www.healthyworkers.gov.au/internet/hwi/publishing.nsf/Content/roi-introduction

Operating system(s): Platform independent

Programming language: HTML

Other requirements: Nil

Any restrictions to use by non-academics: None (free to access)

3.6.1 *Availability of supporting data*

The data supporting the results of this article are included within the article and its additional files.

3.6.2 List of abbreviations

SME Small to medium enterprise

WHO World Health Organization

UK United Kingdom

NICE National Institute for Health and Clinical Excellence

3.7 Competing interests

The authors Siyan Baxter, Sharon Campbell, Kristy Sanderson, Carl Cazaly, Alison Venn, Carole Owen and Andrew Palmer declare that they have no financial competing interests.

The tool remains the non-financial intellectual property interest of the University of Tasmania and the Tasmanian Government.

3.8 Author contribution

SB contributed with the development of the calculator and drafted the manuscript. SC assisted with the original policy-level idea, the development of the calculator and helped draft the manuscript. KS contributed with the original idea and assisted with progression and improvements to the calculator development, and helped improve the manuscript. CC assisted with progression of the calculator to the national platform, and helped improve the manuscript. AV contributed to the policy-research partnership (outlined below under Acknowledgements), assisted with improvements to the calculator, and helped improve the manuscript. CO assisted with formation of the policy-research partnership. AP assisted with improvements to the calculator and manuscript. All authors read and approved the final manuscript.

3.9 Author information

SB is a graduate research PhD candidate, KS is an associate professor, AV and AP are professors at the Menzies Institute for Medical Research, an institute of the University of Tasmania. They are investigators in a large evaluation known as *partnering*Healthy@Work, within which the economic case for a workplace health and wellbeing program implemented by the Tasmanian State Service for the Tasmanian public service employees is being assessed.

In the Tasmanian Government Department of Health and Human Services, SC is a Healthy Workers Initiative project officer, CC is the Healthy Workers Initiative program manager and CO is the project sponsor and deputy director of Population Health and Wellbeing (within Population Health Services).

3.10 Acknowledgments

This study was supported by a partnership research grant from the National Health and Medical Research Council Partnership Projects (Australia); NHMRC grant No H0010501, and additionally through the National Partnership Agreement on Preventive Health, Healthy Workers Initiative – a joint Australian and Tasmanian Government initiative. The partnership grant supported the *partnering*Healthy@Work project, an investigator team drawn from the Menzies Institute for Medical Research, the University of Tasmania, and leading practitioners and policy makers from within the Tasmanian State Service, which was established to

evaluate a workplace health promotion program implemented for Tasmanian public service employees. Furthermore the partnership project provided policy-research collaboration between researchers (Menzies Institute for Medical Research, Tasmania) and policy makers within Population Health Services at the Tasmanian Government Department of Health and Human Services. This afforded a three month (100 hour) practical placement for one of the partnership PhD students (author SB) to provide additional research resources to the Department of Health and Human Services Healthy Workers Initiative team (authors SC, CC, CO) to assist in the development of the Healthy Workplace Resource Toolkit. Moreover, this placement provided a working example of a public service orientated research-policy alliance for authors SB and SC, and demonstrated a positive example of the value of partnership in translational research. Ethics approval for the student placement was granted by the Social Science Human Research Ethics Committee (Tasmania) Network.

3.11 Summary

3.11.1 Background

Workplace health promotion is focussed on improving the health and wellbeing of workers. Although quantifiable effectiveness and economic evidence is variable, workplace health promotion is recognised by both government and business stakeholders as potentially beneficial for worker health and economic advantage. Despite the current debate on whether conclusive positive outcomes exist, governments are investing, and business engagement is necessary for value to be realised. Practical tools are needed to assist decision makers in developing the business case for workplace health promotion programs. Our primary objective was to develop an evidence-based, simple and easy-to-use resource (calculator) for Australian employers interested in workplace health investment figures.

3.11.2 Results

Three phases were undertaken to develop the calculator. First, evidence from a literature review located appropriate effectiveness measures. Second, a review of employer-facilitated programs aimed at improving the health and wellbeing of employees was utilised to identify change estimates surrounding these measures, and third, currently available online evaluation tools and models were investigated. We present a simple web-based calculator for use by employers who wish to estimate potential annual savings associated with implementing a successful workplace health promotion program. The calculator uses effectiveness measures (absenteeism and staff turnover rates) and change estimates sourced from 55 case studies to generate the annual savings an employer may potentially gain. Australian wage statistics were used to calculate replacement costs due to staff turnover. The calculator was named the Workplace Health Savings Calculator and adapted and reproduced on the Healthy Workers web portal by the Australian Commonwealth Government Department of Health and Aging.

3.11.3 Conclusion

The Workplace Health Savings Calculator is a simple online business tool that aims to engage employers and to assist participation, development and implementation of workplace health promotion programs.

3.12 Postscript

This chapter describes the translational development of a WHP resource resulting from a research to policy internship within *partnering*Healthy@Work. The resource included a business justification chapter and a workplace health savings calculator.

A subsequent review and closure report on the Healthy Workplace Resource Toolkit was carried out by the Tasmanian Department of Health and Human Services and other members of the *partnering*Healthy@Work team. The report included an evaluation of responses from Tasmanian employers who piloted the toolkit across public, private and non-government settings (n=20). Specific to the business justification section was their responses to one of the questions I provided: "How would you rate the importance of the following reasons for your workplace to support a WHP program (unimportant, not very, neutral, somewhat, very important)?" There were fifteen business reasons:

> Staff health, Workplace injuries, Employee job satisfaction (enjoyment), Worker Compensation, Absenteeism, Attendance regardless of illness/injury, Productivity, Staff morale, Business image, Recruitment and retention, Job performance/efficiency, Team cohesiveness (work together), Staff engagement, Operational savings, and Increase *profitability*

The percentage of 'very important' responses as valued by the pilot businesses and related to my thesis were: staff health (90%), absenteeism (60%), staff retention (50%), increase profitability (44%), and operational savings (40%).

This Chapter has demonstrated that resources in WHP are needed and sought in both state and federal government arenas to promote acceptable, relevant and usable tools to engage WHP business interest. Taking into consideration the post-review and closure report, input estimates of absenteeism and staff turnover are appropriate measures that are valued by Tasmanian employers, although a greater importance for 'staff health' was indicated as a reason to support a WHP program.

3.13 References

1. Tasmanian Government Department of Premier and Cabinet PSMO. *Healthy@Work Strategic Plan.* Hobart, Tasmania2009.
2. Chu C, Breucker G, Harris N, et al. Health-promoting workplaces—international settings development. *Health Promot Int.* 2000;15(2):155.
3. WHO Global Plan of Action on Workers' Health (2008-2017). Available at http://apps.who.int/gb/ebwha/pdf_files/WHA60/A60_R26-en.pdf.
4. The European Network for Health Promotion (ENWHP). Publications available at http://www.enwhp.org/publications.html Accessed 10 April, 2015.
5. Health at work network of the public health responsibility deal. http://www.dh.gov.uk/en/Publichealth/Publichealthresponsibilitydeal/index.htm
6. Department of Health_UK. The NHS Health and Well Being Improvement framework, Department of Health: 2011 http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_128813.pdf. 2011.
7. NHS;. Workplace Wellbeing Charter, National Award for England. http://wellbeingcharter.org.uk Accessed 5th December, 2014.
8. Patient Protection and Affordable Care Act. Subtitle D-Provisions Relating to Title IV. HR 3590 EAS/PP Available at http://www.hhs.gov/healthcare/rights/law/title/iv-amendments.pdf Accessed March 2014. 2010.
9. Australian Government Department of Health and Ageing; National Partnership Agreement on Preventive Health (NPAPH). http://www.health.gov.au/internet/main/publishing.nsf/Content/phd-prevention-np.
10. World Economic Forum. The New Discipline of Workforce Wellness *Enhancing Corportae Performance by Tackling Chronic Disease*. 2010.
11. Lerner D, Rodday AM, Cohen JT, Rogers WH. A Systematic Review of the Evidence Concerning the Economic Impact of Employee-Focused Health Promotion and Wellness Programs. *J. Occup. Environ. Med.* 2013;55(2):209-222.
12. Malik SH, Blake H, Suggs LS. A systematic review of workplace health promotion interventions for increasing physical activity. *Br J Health Psychol.* Feb 2014;19(1):149-180.
13. Rongen A, Robroek SJW, van Lenthe FJ, Burdorf A. Workplace Health Promotion: A Meta-Analysis of Effectiveness. *Am. J. Prev. Med.* 2013;44(4):406-415.
14. Osilla KC, Van Busum K, Schnyer C, Larkin JW, Eibner C, Mattke S. Systematic review of the impact of worksite wellness programs. *Am. J. Manag. Care.* Feb 2012;18(2):e68-81.
15. Baxter S, Sanderson K, Venn AJ, Blizzard CL, Palmer AJ. The relationship between return on investment and quality of study methodology in workplace health

promotion programs. *Am. J. Health Promot.* 2014;28(6):347-363.

16. Faragher EB, Cass M, Cooper CL. The relationship between job satisfaction and health: a meta-analysis. *Occup. Environ. Med.* Feb 2005;62(2):105-112.
17. Goetzel RZ, Pei X, Tabrizi MJ, et al. Ten modifiable health risk factors are linked to more than one-fifth of employer-employee health care spending. *Health Aff. (Millwood).* Nov 2012;31(11):2474-2484.
18. Williden M, Schofield G, Duncan S. Establishing links between health and productivity in the New Zealand workforce. *J. Occup. Environ. Med.* May 2012;54(5):545-550.
19. British Government Department of Work and Pensions. Workplace Well-being Tool, http://www.dwp.gov.uk/health-work-and-well-being/our-work/workplace-well-being-tool/ Published July 8, 2013. 2013.
20. National Institute for Health and Clinical Excellence. Promoting physical activity in the workplace: business case http://guidance.nice.org.uk/PH13/BusinessCase/xls/English. 2008.
21. WEF World Economic Forum. Workplace Wellness App developed by Boston Consulting Group, available at http://wellness.weforum.org/model.
22. PricewaterhouseCoopers LLP. *Building the case for wellness, London: PWC 2008.* Accessed from http://www.dwp.gov.uk/docs/hwwb-dwp-wellness-report-public.pdf.
23. Grossmeier J, Terry PE, Cipriotti A, Burtaine JE. Best practices in evaluating worksite health promotion programs. *Am. J. Health Promot.* Jan-Feb 2010;24(3):TAHP1-9, iii.
24. Australian Government Department of Health and Aging. *Joint Statement of Commitment: Promoting good heath at work.* Canberra, ACT2011.
25. Australian Government: Department of Innovation Industry Science and Research. *Key Statistics: Australian Small Businesses.* Canberra ACT2011.
26. Buck Consultants LLP. *Working Well: A Global Survey of Health Promotion,Workplace Wellness and Productivity Strategies, .* sixth edition, July 2014.
27. Australian Bureau of Statistics. *Regional Wage and Salary Earner Statistics (Cat. No. 5673.0.55.003). .* Canberra ACT: ABS2008.
28. Australian Human Resources Institute. *HR Pulse 2008, 'Love 'em don't lose 'em' – Identifying Retention Strategies that Work* *http://www.ahri.com.au/MMSdocuments/profdevelopment/research/research_papers/0803_pulse_vol2_no1_love_em_don't_lose_em_web.pdf.* Melbourne, VICTORIA2008.
29. Australian Bureau of Statistics. *Counts of Australian Businesses, Including Entries and Exits, June 2007 until June 2011 (Cat. No. 8165.0).* Canberra, ACT: ABS2012.
30. British Government: Department for Business Innovation and Skills. *Annual Small*

Business Survey 2007/08. 2009.

31. Department of Business Innovation and Skills. *Small and Medium-sized Enterprise (SME) Statistics for the UK and Regions 2009.* London, UK: Government of the United Kingdom2010.
32. Australian Bureau of Statistics. *Year Book Australia (Cat. No. 1310.0).* Canberra ACT: ABS2006.
33. Australian Bureau of Statistics. *Year Book Australia, Population projections - a tool for examining population aging (Cat. No. 1301.0).* Canberra ACT: ABS2008.
34. Australian Bureau of Statistics. *Population projections, Australia, 2006 to 2101 (Cat. No. 3222.0).* Canberra, ACT2008.
35. Australian Bureau of Statistics. *Population projections – a tool for examining population aging (Cat. No. 1301.1); Year Book Australia.* Canberra ACT: ABS2008.
36. British Government Department for Work and Pensions. *Welfare reform* *http://webarchive.nationalarchives.gov.uk/20130128102031/http://www.dwp.gov.uk/welfarereform/c4.asp* 2007.
37. PricewaterhouseCoopers and Medibank Health Solutions. *Workplace wellness in Australia; aligning action with aims: Optimising the benefits of workplace wellness.* www.pwc.com.au2010.
38. WorkSafe Tasmania. Available at www.worksafe.tas.gov.au/industry_and_safety/health_and_wellbeing/simple_guide_resources Accessed on 17 March, 2015.
39. Healthier Workplace WA. Workplace Health Savings Calculator. Available at http://healthierworkplacewa.com.au/learn/workplace-health-savings-calculator/ Accessed on 119 March, 2015.
40. Better Work Tasmania. Workplace health and savings calculator. Available at http://www.betterwork.tas.gov.au/membership_benefits_-_public_promotional_information/workplace_health_and_savings_calculator Accessed on 19 March, 2015.
41. Schultz AB, Edington DW. Employee health and presenteeism: a systematic review. *J Occup Rehabil.* Sep 2007;17(3):547-579.
42. Johns G. Presenteeism in the workplace: A review and research agenda. *J. Org. Behavior.* May 2010;31(4):519-542.
43. Goetzel RZ, Long SR, Ozminkowski RJ, Hawkins K, Wang S, Lynch W. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. *J. Occup. Environ. Med.* Apr 2004;46(4):398-412.
44. Burton WN, Chen CY, Conti DJ, Schultz AB, Pransky G, Edington DW. The association of health risks with on-the-job productivity. *J. Occup. Environ. Med.* Aug 2005;47(8):769-777.
45. Cancelliere C, Cassidy JD, Ammendolia C, Cote P. Are workplace health promotion

programs effective at improving presenteeism in workers? A systematic review and best evidence synthesis of the literature. *BMC public health.* 2011;11:395.

46. Brooks A, Hagen SE, Sathyanarayanan S, Schultz AB, Edington DW. Presenteeism: Critical Issues. *J. Occup. Environ. Med.* Nov 2010;52(11):1055-1067.
47. Koopmanschap M, Burdorf A, Jacob K, Meerding WJ, Brouwer W, Severens H. Measuring productivity changes in economic evaluation: setting the research agenda. *Pharmacoeconomics.* 2005;23(1):47-54.
48. Zhang W, Bansback N, Anis AH. Measuring and valuing productivity loss due to poor health: A critical review. *Soc. Sci. Med.* Jan 2011;72(2):185-192.
49. Drummond MF, Sculpher MJ, Torrance GW. *Methods for the economic evaluation of health care programmes 3rd edition.* Oxford University Press, USA; 2005.
50. National Institute for Health and Clinical Excellence. *Promoting physical activity in the workplace: review decision document (2014). Available at http://www.nice.org.uk/guidance/ph13/documents* Accessed 14 March, 2015.
51. Wang S, Moss JR, Hiller JE. Applicability and transferability of interventions in evidence-based public health. *Health Promot Int.* Mar 2006;21(1):76-83.
52. Australian Bureau of Statistics. *State and Territory Statistical Indicators Cat. No. (1367.0).* Canberra ACT: ABS2011.

Appendix 3A The Healthy Workplace Resource Toolkit: “How will a health and wellbeing program improve my bottom line?”

This toolkit was published by the Tasmanian Government in February 2012 and updated in July 2015. It is still currently available in its updated form online on the Worksafe Tasmania website www.worksafe.tas.gov.au

The full toolkit consists of 106 pages. In the interests of conservation, I have attached only the contents page and specific section (Section 03) that relates to my internship outcomes.

HOW TO USE THIS TOOLKIT

The Healthy Workplace Resource Toolkit is divided into the following sections.

A healthy workplace is good for business 3

03
HOW WILL A HEALTH AND WELLBEING PROGRAM IMPROVE MY BOTTOM LINE?

Key questions to ask

- What are the impacts on business performance?
- How can I calculate the financial benefit to my organisation?

WHAT ARE THE IMPACTS ON BUSINESS PERFORMANCE?

Given the close link between healthy employees and business performance,[1] a workplace health and wellbeing program has the potential to have a positive impact on your business productivity.

In the short term, the success of your health and wellbeing program will be demonstrated by improvements in the way your employees:

- work together
- engage in their jobs
- enjoy their work.

In the long term, you should see the positive influence of your program on your organisation's business performance through:

- gains in staff retention
- improved efficiency
- enhanced corporate image
- reduced absenteeism and presenteeism
- reduced disability claims.

Some of these improvements are harder to measure than others, but each will contribute to improving your business bottom line.

Business performance fast facts

- For every dollar invested in workplace health and wellbeing programs, there is a return on investment of between three and six dollars.[2]
- Reduced performance costs employers two to seven times more than absenteeism.[3]
- In 2005-2006, the cost of work-related injury and illness in Australia was estimated to be $57.5 billion (5.9% GDP), of which employers bore $10.2 billion.[4]
- The greater the number of health risks per employee, the greater the negative impact on their productivity.[5]
- Implementing a health and wellbeing program can reduce employee risk factors by up to 56%.[6]

WHAT ARE THE IMPACTS ON BUSINESS PERFORMANCE?

Your workplace health and wellbeing program may also have a direct impact on your business environment by addressing some common business issues.

Issue		Potential impact
Over the next 15 years there will be a four-to-five times increase in the number of Australian workers eligible for retirement.[7]	→	Healthy workers stay in the workforce longer.
By 2015 there will be a significant shortfall of qualified people in the workforce.[8]	→	Trained staff who have high job satisfaction are more easily retained.
82% of Australian businesses report they have a skills gap, which leads to higher levels of work stress and lower morale.[9]	→	Workplace health and wellbeing programs can assist in managing work stress levels and improve morale among your employees.

Let's see how you can turn this into dollars in your pocket.

HOW CAN I CALCULATE THE FINANCIAL BENEFIT TO MY ORGANISATION?

Two of the more tangible ways that employee health can have an immediate financial benefit to your organisation is through reducing:

1. Absenteeism
2. Staff turnover.

The following exercise will help you calculate the impact a successful workplace health and wellbeing program can have on staff absenteeism and turnover rates. Where a percentage range is provided, the percentage that calculates the most conservative saving is used.

1. Absenteeism

Fill in the following spaces to estimate the cost of absenteeism to your organisation.

Total number of employees	________	(A)
Sick leave rate per employee per year (in days)	________	(B)
OR		
Total number of sick days in last 12 months	________	(C)
Hours worked per day	________	(D)
Average hourly wage ($)	________	(E)
Total annual cost of staff sick leave	$________	(F) (A x B x D x E) or (C x D x E)

It is estimated that a successful workplace health and wellbeing program can decrease staff absenteeism by an average of 30-40%.[3]

Reduction in sick leave (%)	30%	(G)
Total annual savings in sick leave achievable by implementing a workplace health and wellbeing program	**$________**	**(H) (F x G)**

2. Staff turnover

Fill in the following spaces to estimate the cost of staff turnover to your organisation.

Total number of employees resigned in the last 12 months	________	(I)
Average annual gross wage ($)	________	(J)

It is estimated that the cost of replacing an employee is 75-150% of the employee's salary.[10]

Cost of replacing an employee as a percent of annual salary	75%	(K)
Annual cost of replacing employees as a result of resignation	$________	(L) (I x J x K)

It is estimated that a successful workplace health and wellbeing program can decrease staff turnover by an average of 10-25%.[3]

Reduction in staff turnover (%)	10%	(M)
Total annual savings in staff turnover achievable by implementing a workplace health and wellbeing program	**$________**	**(N) (L x M)**
Total annual savings as a result of implementing a successful workplace health and wellbeing program	**$________**	**(O) (H + N)**

HOW CAN I CALCULATE THE FINANCIAL BENEFIT TO MY ORGANISATION?

The following example illustrates these calculations.

In the last 12 months, a company of 50 staff has experienced a sick leave rate of 8.5 days per employee and has recruited 3 replacement staff due to resignations. The average staff salary is $50,000. The company runs a shift roster of 8-hour days and the average hourly wage is $25.

Total number of employees	50	(A)
Sick leave rate per employee per year (in days)	8.5	(B)
Total number of sick days in last 12 months	425	(C)
Hours worked per day	8	(D)
Average hourly wage ($)	25	(E)
Total annual cost of staff sick leave	$85000	(F) (A x B x D x E)
Reduction in sick leave due to a workplace health and wellbeing program (%)	30%	(G)
Total annual savings in sick leave achievable by implementing a workplace health and wellbeing program	**$25500**	**(H) (F x G)**
Total number of employees resigned in the last 12 months	3	(I)
Average annual wage ($)	50000	(J)
Cost of replacing an employee as a percent of annual salary	75%	(K)
Annual cost of replacing employees as a result of resignation	$112500	(L) (I x J x K)
Reduction in staff turnover due to a workplace health and wellbeing program (%)	10%	(M)
Total annual savings in staff turnover achievable by implementing a workplace health and wellbeing program	**$11250**	**(N) (L x M)**
Combined annual savings for reduced sick leave and staff turnover, as a result of implementing a successful workplace health and wellbeing program	**$36750**	**(O) (H + N)**

In this example, the organisation has potential annual savings of over $36000 through minimising absenteeism and staff turnover. Other less tangible savings could be made through increased productivity, staff engagement and morale.

What might be the potential savings for your business?

HOW WILL A HEALTH AND WELLBEING PROGRAM IMPROVE MY BOTTOM LINE?

REFERENCES

1. ComCare, *Putting you first. Benefits to business: the evidence for investing in worker health and wellbeing*, Australian Government, available from <www.comcare.gov.au/__data/assets/rtf_file/0006/99348/01410_WH_and_S_Benefits_to_business_v1.rtf>.
2. Bellew, B 2008, *Primary prevention of chronic disease in Australia through interventions in the workplace setting: a rapid review*, Sax Institute for the Chronic Disease Prevention Unit, Department of Human Services, Victoria.
3. Main, C, Glozier, N, Wright, I 2005, 'Validity of the HSE stress tool: an investigation within four organizations by the Corporate Health and Performance Group', *Occupational Medicine*, 55:208–214.
4. Australian Safety and Compensation Council 2009, *The cost of work-related injury and illness for Australian employers, workers and the community: 2005-2006*, Australian Safety and Compensation Council, Canberra.
5. Musich, S, Hook, D, Baaner, S, Edington, DW 2006, 'The association of two productivity measures with health risks and medical conditions in an Australian employee population', *American Journal of Health Promotion*, 20(5):353-63.
6. Wesley Corporate Health Pty Ltd 2006, *The future@work health report: employees and their workplace*, Australia.
7. Speech by Bronwyn Bishop to the National Press Club, *A national strategy for an ageing Australia*, 8 June 1999, Canberra.
8. Skills Australia 2010, *Australian Workforce futures: a national workforce development strategy*, available from <www.skillsaustralia.gov.au>.
9. Australian Institute of Management Victoria/Tasmania 2011, *Australia's 'skills gap'*, available from <www.aimvic.com.au/emails/PDF/survey_SkillsGap2011.pdf>.
10. Australian Human Resources Institute 2008, *'Love 'em don't lose 'em'—identifying retention strategies that work*, HRpulse Research Report, available from <www.ahri.com.au/MMSdocuments/profdevelopment/research/research_papers/0803_pulse_vol2_no1_love_em_don't_lose_em_web.pdf>

FURTHER READING

For more information on the business benefits of workplace health and wellbeing programs, download the following resources from the attached CD-ROM or from the *Good health. Good business.* website.

3.1 – Medibank Private: Workplace wellness in Australia

3.2 – ComCare: Benefits to business – The evidence for investing in worker health and wellbeing

Appendix 3B Print version of the simple Workplace Health Savings Calculator as it appeared in the Healthy Workplace Resource Toolkit

HOW CAN I CALCULATE THE FINANCIAL BENEFIT TO MY ORGANISATION?

Two of the more tangible ways that employee health can have an immediate financial benefit to your organisation is through reducing:
1. Absenteeism
2. Staff turnover.

The following exercise will help you calculate the impact a successful workplace health and wellbeing program can have on staff absenteeism and turnover rates. Where a percentage range is provided, the percentage that calculates the most conservative saving is used.

1. Absenteeism

Fill in the following spaces to estimate the cost of absenteeism to your organisation.

Total number of employees _______ (A)
Sick leave rate per employee per year (in days) _______ (B)
OR
Total number of sick days in last 12 months _______ (C)
Average hours worked per day _______ (D)
Average hourly wage ($) _______ (E)
Total annual cost of staff sick leave $______ (F) (A x B x D x E or (C x D x E)

It is estimated that a successful workplace health and wellbeing program can decrease staff absenteeism by an average of 30-40%[22]

Reduction in sick leave (%) 30% (G)
Total annual savings in sick leave achievable by implementing a workplace health and wellbeing program $______ (H) (F x G)

2. Staff turnover

Fill in the following spaces to estimate the cost of staff turnover to your organisation.

Total number of employees resigned in the last 12 months _______ (I)
Average annual gross wage ($) _______ (J)

It is estimated that the cost of replacing an employee is 75-150% of the employee's salary[27]

Cost of replacing an employee as a percent of annual salary 75% (K)

Annual cost of replacing employees as a result of resignation $ _______ (L) (I x J x K)

It is estimated that a successful workplace health and wellbeing program can decrease staff turnover by an average of 10-25%.[22]
Reduction in staff turnover (%) 10% (M)
Total annual savings in staff turnover achievable by implementing a workplace health and wellbeing program $_______(N) (L x M)
Total annual savings as a result of implementing a successful workplace health and wellbeing program $_______(O) (H + N)

Appendix 3C Example which accompanied the simple Workplace Health Savings Calculator in the Healthy Workplace Resource Toolkit

HOW CAN I CALCULATE THE FINANCIAL BENEFIT TO MY ORGANISATION?

The following example illustrates these calculations.

In the last 12 months, a company of 50 staff has experienced a sick leave rate of 8.5 days per employee and has recruited 3 replacement staff due to resignations. The average staff salary is $50,000. The company runs a shift roster of 8-hour days and the average hourly wage is $25.

Total number of employees	50	(A)	
Sick leave rate per employee per year (in days)	8.5	(B)	
Total number of sick days in last 12 months	425	(C)	
Hours worked per day	8	(D)	
Average hourly wage ($)	25	(E)	
Total annual cost of staff sick leave	$85 000	(F)	(A x B x D x E)

Reduction in sick leave due to a workplace health and wellbeing program (%)	30%	(G)	
Total annual savings in sick leave achievable by implementing a workplace health and wellbeing program	**$25 500**	**(H)**	**(F x G)**

Total number of employees resigned in the last 12 months	3	(I)	
Average annual wage ($)	50 000	(J)	
Cost of replacing an employee as a percent of annual salary	75%	(K)	
Annual cost of replacing employees as a result of resignation	$112 500	(L)	(I x J x K)
Reduction in staff turnover due to a workplace health and wellbeing program (%)	10%	(M)	
Total annual savings in staff turnover achievable by implementing a workplace health and wellbeing program	**$11 250**	**(N)**	**(L x M)**

Combined annual savings for reduced sick leave and staff turnover, as a result of implementing a successful workplace health and wellbeing program	**$36 750**	**(O)**	**(H + N)**

In this example, the organisation has potential annual savings of over $36 000 through minimising absenteeism and staff turnover. Other less tangible savings could be made through increased productivity, staff engagement and morale.

Appendix 3D Publication of "Development of the Workplace Health Savings Calculator; a Practical Tool to Measure Economic Impact from Reduced Absenteeism and Staff Turnover in Workplace Health Promotion"

Baxter S, Campbell S, Sanderson K, Cazaly C. Venn AJ, Owen C, Palmer AJ. "Development of the Workplace Health Savings Calculator; a Practical Tool to Measure Economic Impact from Reduced Absenteeism and Staff Turnover in Workplace Health Promotion" *BMC Research Notes – Technical Note* (2015) 8:457

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BMC Research Notes

TECHNICAL NOTE

Open Access

Development of the Workplace Health Savings Calculator: a practical tool to measure economic impact from reduced absenteeism and staff turnover in workplace health promotion

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Abstract

Background: Workplace health promotion is focussed on improving the health and wellbeing of workers. Although quantifiable effectiveness and economic evidence is variable, workplace health promotion is recognised by both government and business stakeholders as potentially beneficial for worker health and economic advantage. Despite the current debate on whether conclusive positive outcomes exist, governments are investing, and business engagement is necessary for value to be realised. Practical tools are needed to assist decision makers in developing the business case for workplace health promotion programs. Our primary objective was to develop an evidence-based, simple and easy-to-use resource (calculator) for Australian employers interested in workplace health investment figures.

Results: Three phases were undertaken to develop the calculator. First, evidence from a literature review located appropriate effectiveness measures. Second, a review of employer-facilitated programs aimed at improving the health and wellbeing of employees was utilised to identify change estimates surrounding these measures, and third, currently available online evaluation tools and models were investigated. We present a simple web-based calculator for use by employers who wish to estimate potential annual savings associated with implementing a successful workplace health promotion program. The calculator uses effectiveness measures (absenteeism and staff turnover rates) and change estimates sourced from 55 case studies to generate the annual savings an employer may potentially gain. Australian wage statistics were used to calculate replacement costs due to staff turnover. The calculator was named the Workplace Health Savings Calculator and adapted and reproduced on the Healthy Workers web portal by the Australian Commonwealth Government Department of Health and Ageing.

Conclusion: The Workplace Health Savings Calculator is a simple online business tool that aims to engage employers and to assist participation, development and implementation of workplace health promotion programs.

Keywords: Workplace health promotion, Health economics, Return on investment, Calculator, Absenteeism, Staff turnover, Productivity, Workplace, Employee, Policy-research collaboration

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Background

Improving the health and wellbeing of workers is firmly on the public health and business agenda. The World Health Organisation (WHO) has identified the workplace as a target setting for health promotion [1], and formed a Global Plan of Action on Workers' Health (2008–2017) [2] to protect and promote health at work and respond to the health needs of the working population. Endorsement of this action plan is evidenced in the emergent company and society-wide shift to include workplace health promotion as a key strategy. Consequently, workplace health has gained profile as a strategic asset to economies, as revealed in various international reports and policy guidelines [3–9]. This stands, despite recent inconclusive reviews on whether health and economic outcomes are positive, negative or neutral [10–13], and an extensive review that demonstrated economic evidence, although improving over time, is low to moderate in methodological quality [14]. Nonetheless, the evidence that healthy employees provide social and economic benefits to businesses and the community continues to be largely accepted. These include reductions in absenteeism from illness and injury, increased productivity, reduced staff turnover, reduction in health care costs and a more satisfied work force [14–17].

Health economics offers an analytical technique to measure the financial impact of health-promoting initiatives in order to assess allocation efficiency and determine whether or not an intervention is worthwhile. Although it is important for government, organisations and businesses to accurately measure the rate of return on investments, the application of health economic theory in workplace health is steeped in methodological complexities [14]. Primarily, economic evaluations focus on indicators of business performance and health change targets. Although tools such as workplace health calculators are available for decision makers who wish to create a business case for workplace health, those that currently exist online have been developed from evidence arising out of the Unites States and the United Kingdom with financial estimates available in British pound [18, 19] and United States dollar [20], and the latter only suitable to businesses with greater than 1000 employees based in US, Europe, India and China. Little is available to assist other jurisdictions in the business case for workplace health, both in terms of currency output and simple translation, and as a result, the adoption of these existing online-calculators can be problematic.

In 2009 the Australian Government established the National Partnership Agreement on Preventive Health initially promising an investment of $221.8 million over nine years (2009–2010 to 2017–2018) [8]. This commitment provided funding to all states and territories to support the Healthy Workers Initiative and enabled Australian health policy-makers to engage in a common mission to improve and maintain the health and wellbeing of workers. With this support, a Healthy Workers Initiative project team was developed within Population Health Services in the Tasmanian Department of Health and Human Services. One of the many objectives of the project team was to develop an evidence-based, simple and easy-to-use resource (calculator) for Australian employers interested in workplace health investment figures, and make this available through the Healthy Workplace Resource Toolkit.

This paper describes the development of the Workplace Health Savings Calculator, a toolkit output that is currently available online.

Data collection

Data were collected in three phases (1) locate appropriate effectiveness measures, (2) identify change estimates surrounding these measures and (3) decide on an appropriate model.

To satisfy the first phase, a literature review was being performed by SB, AP, KS and AV (the researchers) at the time the Healthy Worker Initiative project team members SC and CO approached with the question "What is the evidence-based business case for workplace health promotion?" A partnership agreement was established and researchers utilised their concurrent literature search for the purposes of providing economic evidence to assist the development of the Healthy Workplace Resource Toolkit. The search was conducted in relevant economic and biomedical databases between November 2011 and January 2012. In addition, a keyword search using Google Scholar and a manual search of citations from relevant papers was undertaken to locate published evidence on the financial impact of workplace health promotion. The search strategy has been published along with the review [14]. Information gained from this review was utilised to ascertain measures of effectiveness which contextually provided transferability and generalisability to the Australian sector. Two measures of effectiveness were recognised as business metrics most readily captured in operations. These were worker 'absenteeism' and 'staff turnover'. Both were adopted as the key performance estimates for the calculator.

The second requirement in the development phase was to establish the magnitude of possible change in absenteeism and staff turnover as a result of implementing a workplace health program. These estimates of change for absenteeism and staff turnover were sourced from a second review study [21] which readers can refer to for additional information. This review, published in 2008, was commissioned by the Health Work Wellbeing Executive in England and undertaken by PriceWaterhouseCoopers LLP. Under the constraints identified in the first review, namely, that no Australian equivalent published data source existed, that volume of publications from the United States far exceeded that from jurisdictions operating under a national health care system, and that large variability in both estimates and methodological quality of studies prevail, the authors considered this PriceWaterhouseCoopers' review to be most appropriate for our needs and of sound evidence base. Moreover, the evidence from this review is cited and supports the Workplace Wellbeing Charter [6], a national award, whose "standards reflect best practice" and is endorsed by Public Health England.

Finally, an internet search was conducted to locate workplace health calculators currently in existence. These were assessed for their ease of use and applicability to the Australian business context. As a result of this search, a model developed by the National Institute for Health and Clinical Excellence (NICE) [19] was considered simple to use and adapted for our purposes.

Assumptions used to develop the tool

In developing the tool, the following assumptions were made. First, 'absenteeism' (or 'sick leave') was defined as an employee's unplanned leave from work, not including other leave such as carer's leave or maternity leave. Examples of unplanned leave would be due to illnesses such as colds and flu.

Second, a workplace health promotion program was considered 'successful' when it was designed to target the needs of employees, when participation rates were reasonable (greater than 25 % participation), and the program was actively supported by senior management and leaders within the organisation.

Third, different types of workplace health promotion interventions (health and safety, disease management, and health promotion—the modification of risk behaviours such as smoking, nutrition, physical activity and stress to improve overall employee wellbeing) contributed equally, and were linked to the improvement of the effectiveness estimates.

Last, calculated savings were assumed to be a long-term benefit. It is evidenced in the literature that positive effects on absenteeism and staff turnover occur between 2 and 5 years post implementation of a successful workplace health program [22].

The PriceWaterhouseCoopers' review [21], from which the magnitude of change for absenteeism and staff turnover was sourced, included 55 case studies from organisations in the United Kingdom that implemented a variety of workplace health promotion programs. The case studies were submitted to the Health Work Wellbeing Executive and PricewaterhouseCoopers LLP was commissioned to undertake a review including interviews with selected organisations. Overall, 45 case studies reported evidence on change related to absenteeism and 18 on staff turnover, with 28 (51 %) providing evidence from behaviour modification or lifestyle programs such as smoking cessation, healthy diet and subsidised exercise programmes. These interventions focussed on similar behavioural and lifestyle health risk change targets to those encouraged in Australia, which are commonly referred to as SNAPS (smoking, nutrition, alcohol, physical activity, stress) interventions [23]. There were 32 case studies (58 %) focussed on occupational health and safety interventions. The data were collected from businesses within nine different industries; defined as manufacturing, finance, public service, utilities, business services, construction/engineering, retail, education, and others. Company size and intervention type by industry group for all case studies is provided in Appendix 2b of the source review [21]. Their diversity represented a good range of industry types relevant to Australia, with national statistics identifying the vast majority of Australian businesses operate in the service sectors (construction, professional/scientific/technical, retail trade, education, accommodation, transport, and utilities), with the remaining in manufacturing, mining agriculture/forestry and fishing [24]. Further similarities between these two nations such as the proportion of small to medium businesses, population demographics and drivers for workplace health promotion are shown in Table 1.

Global trends in employer wellbeing strategies and practices were reported in 2014 [25]. Data were collected from 37 countries (in 11 languages) that included 1041 employer-participants (8 million employees) across all industry categories. Although it documented similarities between Australia/New Zealand and Europe in terms of percentages of organisations offering health promotion, health risk drivers (namely stress, physical activity, nutrition), and types of program components, no evidence relating to differences in effect size between countries was obtained. There is paucity in the literature surrounding between-country magnitudes of effect in workplace health promotion. Consequently, within the calculator, functionality allows change estimates for absenteeism and staff turnover to be edited by the user, and the default figure represents the lowest effectiveness estimate from the range reported in the UK PricewaterhouseCoopers' review. Refer to Table 2 for change estimates and ranges. This most conservative approach acknowledges that these benefits may not be fully transferable to the Australian context.

When an average effectiveness estimate was reported, it was assumed the average was an average across the

Table 1 Generalisability of the source review

Parameters	Australia	United Kingdom (UK)	Comments/assumptions
SME proportion	99.7 % [42]	99.9 % [43, 45]	UK effectiveness estimates in report derived from similarly high proportion of SMEs to Australia*
Industry types	85 % of SMEs operate in the service sectors (construction (14 %), professional/scientific/technical (12 %), retail trade (10 %) and others including education, accommodation, transport, utilities), with the remaining in agriculture/forestry and fishing (8 %), manufacturing (6 %) and mining (1 %) [24]	Data from 9 industries: manufacturing, finance, public service, utilities, business services, construction/engineering, retail, education, others [21]	Good range of industry types relevant to Australian industry. Construction industry reported effectiveness for occupational health and safety (OH&S) interventions only
Aging population	In 2005, median age 36.6 years [46] By 2050, median age 45 [47] 1 in 4 Australians aged 65 years or over by 2056 [48]	In 2005 median age 39 years [46] By 2050, median age 43 [47] Between 1971 and 2006, those aged 65 years increased by 31 % [21]	Similar population aging demographics
Aging workforce	By 2050, 26 % over 65 years [49]	By 2024, 50 % over 50 years [50] By 2050, 24 % over 65 years [49]	Similar workforce demographics
Drivers	Human capital**, government initiative, OH&S [51]	Government, social responsibility, rising cost of human capital [21]	Similar implementation drivers
Intervention targets	SNAPS (i.e.: smoking, nutrition, alcohol, physical activity, stress) behavioural and lifestyle health risks [23]	51 % (28/55) lifestyle (i.e.: smoking cessation, healthy diet and subsidised exercise programmes) 58 % (32/55) OH&S [21]	Lifestyle interventions focus on similar behaviour change targets to those encouraged in Australia and are also those most commonly seen in research of behaviour modification health interventions in the workplace

Source review: PricewaterhouseCoopers LLP was commissioned by the Health Work Wellbeing Executive to undertake a review of the business case for workplace health, which included a review of 55 case studies from United Kingdom organisations [21]

* There were seven SMEs (small to medium enterprises) of the 55 case studies in the source review: two measured absenteeism, one measured staff retention, three measured both absenteeism and staff retention, and one measured absenteeism (from OH&S interventions only). In their reported benefits, all SMEs saw decreased absenteeism and improved retention

** Human capital: drivers include talent attraction, retention and ideas of broader corporate social responsibility. This approach also seeks to improve productivity and reduce workforce absenteeism [51]

Table 2 Change estimates used within the Workplace Health Savings Calculator

Change estimate	Source	Measurement	Assumption
Absenteeism (% decrease)	PWC 2008 [21][a]	Average 30–40 % reduction, based on 45/55 case studies	The other 10 studies did not measure the perceived benefits of AB, so average holds for all that do
Staff turnover (replacement cost)	ABS 2008 [26]	75–150 % salary as replacement cost Industry types: engineering, construction, professional services (e.g.: finance, admin), public service, resources (e.g.: agriculture, mining) retail and entertainment	75 % a conservative assumption used in place of conclusive evidence
Staff turnover (% decrease)	PWC 2008 [21]	10–25 % decrease in staff turnover, based on 18/55 case studies. On average this retention range was 20–25 % (from 4 industry categories: finance, utilities, business service, and other)	That 37 case studies did not report on turnover, average based on the 18 studies that did. Average holds as an average for all

[a] These were extracted from the source review [21] of 55 case studies that had varying durations of implementation. It has been shown in the literature that benefits from reduced absenteeism and staff turnover may not be realised before 2 and 5 years after implementation of a successful workplace health promotion program [22]. We wish to reiterate an assumption outlined in this study that the calculated potential annual savings is a long-term benefit

case studies that measured that particular effectiveness outcome. It was therefore presumed the average would apply for any business that measured these particular outcomes after implementation of a workplace health promotion program.

In concluding the assumptions used to develop the Workplace Health Savings Calculator, this tool is considered by the authors to be most appropriate for use in Australia, on the following basis; (1) input estimates for absenteeism and staff turnover are generated by the Australian user company, (2) cost estimates are derived using Australian wage statistics, and (3) change estimates from the PriceWaterhouseCoopers' review are (a) most conservative and (b) generalizable to the Australian business context. The Workplace Health Savings Calculator specifically does not attempt to measure or quantify in dollar value any additional health benefits that may be enjoyed by employees undertaking health promotion in their workplace; as such estimates remain elusive in the literature [14].

Description of user interface

The calculator was adapted from a model developed by the National Institute for Health and Clinical Excellence (NICE) [19], and consists of three tabs (Fig. 1). The first allows the user to input relevant data on employee numbers and salary, the second to input data on staff turnover, and the third tab calculates the total potential annual savings that arise from the implementation of a successful workplace health promotion program. Below the savings output on this third and final tab is an organisational profile box which users have the option to complete and submit (Fig. 2). The submitting user maintains anonymity of the company name yet provides the site administrator with base level information about the company, such as industry type, business size and locality. Lastly, for users who wish to identify themselves, there is an option at the bottom of the box to submit an email via a 'Contact us' hyperlink.

For companies whose staffing profile does not solely consist of full-time employees, an additional feature was added to account for part-time and casual positions. For these businesses, where total number of full-time equivalent hours may not be recorded, there is an option within the calculator that allows the user to input 'total number of sick days in the last 12 months' instead of 'total number of employees'. This feature simplifies the data gathering process, and allows users to choose between two algorithms in order to estimate, with minimal burden, the total annual savings in sick leave achievable by implementing a successful workplace health and wellbeing program.

Tabs one and two use effectiveness estimates to derive savings that arise from reduced absenteeism and staff turnover, which is defaulted to the most conservative estimates and can be overridden by the user. It was envisioned that the default estimates may be overridden by companies that are already implementing a program for which company-specific evaluation data were available, and for whom an online-generated calculation of annual savings offered some utility.

The effectiveness estimates within the calculator are sourced from the PriceWaterhouseCoopers' review [21] and Australian wage statistics [26]. These were absenteeism rates, which reduce by an average of 30–40 % [21]; staff turnover rates, which decrease by 10–25 % [21]; and replacement cost due to staff turnover, which ranged from 75 to 150 % of the worker's wage, an Australian national estimate [26]. There were many and various costs associated with this measure, such as costs for recruitment, training, specialist knowledge and productivity [27] which could account for the large range that was reported. In line with agreed assumptions, the most conservative estimates were used in the model

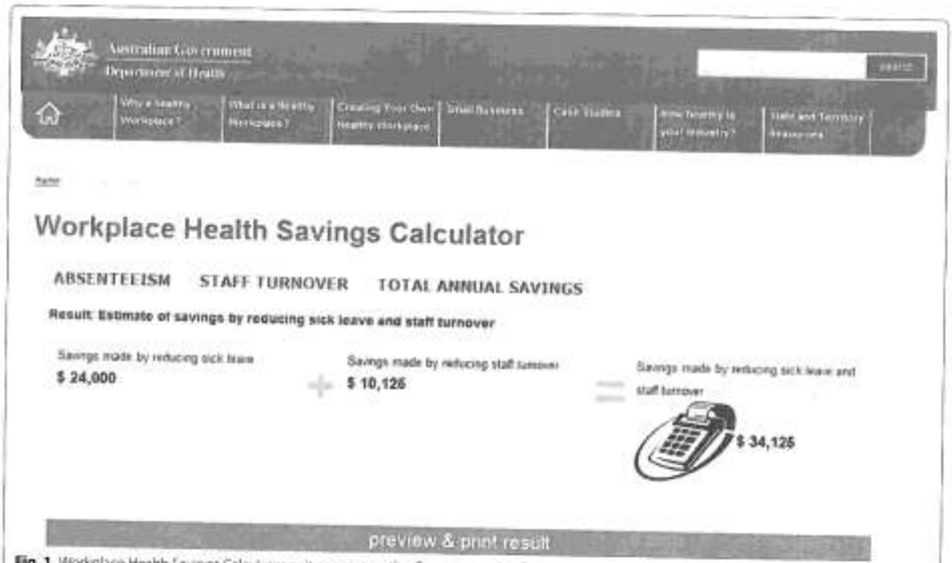

Fig. 1 Workplace Health Savings Calculator as it appears on the Commonwealth Government's Department of Health, Healthy Workers web portal. The following scenario is an example of a company profile whose input would match these calculations. In the last 12 months, a company of 100 employees has experienced a sick leave rate of 4 days per employee (total annual sick days 400) and has recruited 3 replacement staff. The average staff salary is $45,000. The company operates 8 h a day and the average hourly wage is $25. The estimated potential savings to the company when implementing a successful workplace health and wellbeing program is set at the default effectiveness measures; a 30 % reduction in sick leave and a 10 % reduction in staff turnover. The cost of replacing an employee is defaulted at 75 % of the annual salary

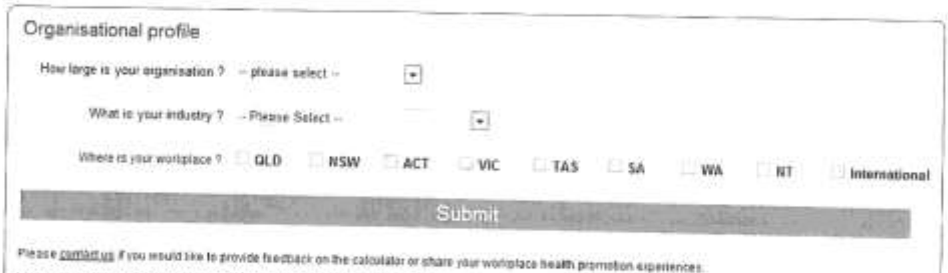

Fig. 2 Screen that accompanies the Workplace Health Savings Calculator for purposes of data collection. The data is non-identifiable unless users wish to identify themselves by submitting an email via the 'Contact us' hyperlink option at the bottom of this organisational profile box

when a range of estimates were offered. Details of these change estimates used and generalisability are provided in Tables 1 and 2.

The calculator was initially published in print within the Healthy Workplace Resource Toolkit (Table 3) with an accompanying page offering an example of the algorithm (Table 4). In 2013 a Microsoft Excel spreadsheet was developed and the calculator was published on the WorkSafe Tasmania website [28].

The algorithm was later adapted and reproduced by the Australian Government Department of Health and Ageing for use on the Healthy Workers web portal, as

Table 3 Print version of the simple Workplace Health Savings Calculator as it appeared in the Healthy Workplace Resource Toolkit

HOW CAN I CALCULATE THE FINANCIAL BENEFIT TO MY ORGANISATION?

Two of the more tangible ways that employee health can have an immediate financial benefit to your organisation is through reducing:
1. Absenteeism
2. Staff turnover.
The following exercise will help you calculate the impact a successful workplace health and wellbeing program can have on staff absenteeism and turnover rates. Where a percentage range is provided, the percentage that calculates the most conservative saving is used.

1. Absenteeism

Fill in the following spaces to estimate the cost of absenteeism to your organisation.

Total number of employees	______	(A)
Sick leave rate per employee per year (in days)	______	(B)
OR		
Total number of sick days in last 12 months	______	(C)
Average hours worked per day	______	(D)
Average hourly wage ($)	______	(E)
Total annual cost of staff sick leave	$______	(F) (A x B x D x E) or (C x D x E)

It is estimated that a successful workplace health and wellbeing program can decrease staff absenteeism by an average of 30-40%[21]

Reduction in sick leave (%)	30%	(G)
Total annual savings in sick leave achievable by implementing a workplace health and wellbeing program	**$______**	**(H) (F x G)**

2. Staff turnover

Fill in the following spaces to estimate the cost of staff turnover to your organisation.

Total number of employees resigned in the last 12 months	______	(I)
Average annual gross wage ($)	______	(J)

It is estimated that the cost of replacing an employee is 75-150% of the employee's salary[28]

Cost of replacing an employee as a percent of annual salary	75%	(K)
Annual cost of replacing employees as a result of resignation $	______	(L) (I x J x K)

It is estimated that a successful workplace health and wellbeing program can decrease staff turnover by an average of 10-25%.[21]

Reduction in staff turnover (%)	10%	(M)
Total annual savings in staff turnover achievable by implementing a workplace health and wellbeing program	**$______**	**(N) (L x M)**
Total annual savings as a result of implementing a successful workplace health and wellbeing program	**$______**	**(O) (H + N)**

Table 4 Example which accompanied the simple Workplace Health Savings Calculator in the Healthy Workplace Resource Toolkit

HOW CAN I CALCULATE THE FINANCIAL BENEFIT TO MY ORGANISATION?

The following example illustrates these calculations.

In the last 12 months, a company of 50 staff has experienced a sick leave rate of 8.5 days per employee and has recruited 3 replacement staff due to resignations. The average staff salary is $50,000. The company runs a shift roster of 8-hour days and the average hourly wage is $25.

Total number of employees	50	(A)
Sick leave rate per employee per year (in days)	8.5	(B)
Total number of sick days in last 12 months	425	(C)
Hours worked per day	8	(D)
Average hourly wage ($)	25	(E)
Total annual cost of staff sick leave	$85 000	(F) (A x B x D x E)
Reduction in sick leave due to a workplace health and wellbeing program (%)	30%	(G)
Total annual savings in sick leave achievable by implementing a workplace health and wellbeing program	**$25 500**	**(H) (F x G)**
Total number of employees resigned in the last 12 months	3	(I)
Average annual wage ($)	50 000	(J)
Cost of replacing an employee as a percent of annual salary	75%	(K)
Annual cost of replacing employees as a result of resignation	$112 500	(L) (I x J x K)
Reduction in staff turnover due to a workplace health and wellbeing program (%)	10%	(M)
Total annual savings in staff turnover achievable by implementing a workplace health and wellbeing program	**$11 250**	**(N) (L x M)**
Combined annual savings for reduced sick leave and staff turnover, as a result of implementing a successful workplace health and wellbeing program	**$36 750**	**(O) (H + N)**

In this example, the organisation has potential annual savings of over $36 000 through minimising absenteeism and staff turnover. Other less tangible savings could be made through increased productivity, staff engagement and morale.

part of its official toolbox for the economic assessment of workplace health promotion programs. Titled "The Workplace Health Savings Calculator", it is available at: http://www.healthyworkers.gov.au on the home screen in the 'News' link (or via direct link: http://www.healthyworkers.gov.au/internet/hwi/publishing.nsf/Content/roi-introduction).

Since its national online publication, the tool has been endorsement by an Australian non-government organisation and commercial providers of workplace health promotion and their respective networks. Further adaptions of the calculator can be viewed online [29, 30]. Evidence regarding its usability and further application are being collected through the organisational profile box and ongoing collaborator consultations. Initial data from the first year demonstrate the calculator has been accessed by a variety of businesses within the industries of Agriculture, Forestry & Fishing; Health and Community Services; Education; Government Administration and Defence; Retail; Electricity, Gas and Water;

and Personal and Other Services. Data also indicate these businesses are located across every state and territory in Australia, and in both metropolitan and regional areas. Two international companies have also completed the organisational profile. The majority of organisations (88 %) employed less than 200 workers of which 40 % identified as small in size (1–19 employees). These initial statistics are encouraging, and not only demonstrate an interest in workplace health promotion from the Australian small-to-medium enterprise (SME) community but also across the entire country.

Discussion

The Workplace Health Savings Calculator is an online tool for estimating the economic impact of improved productivity from the implementation of a successful workplace health promotion program. It utilises a conservative set of assumptions to generate an estimate of potential annual savings. It calculates financial benefits related to reduced absenteeism and staff turnover using input estimates (number of employees, sick leave rates, average hours worked, average wage, number of resignations) that are generated at the individual company level. Annual turnover and number of employees are tangible key performance estimates most commonly measured in Australia [24]. The estimate for cost to replace staff is an Australian statistic [26]. Although commonly measured, there is a lack of Australian evidence on absenteeism and staff turnover in relation to workplace health promotion outcomes and the authors were required to carefully consider the vast and varying evidence on effectiveness and cost-effectiveness in the global literature. This was achieved in concurrence with a systematic review undertaken by the authors SB, AP, KS and AV [14]. It was considered that these two metrics (absenteeism and staff turnover) provided (1) the ease of measurement needed, and (2) best attainable estimates to attribute a dollar value, and thereby met our primary objective to develop an evidence-based, simple and easy-to-use resource (calculator) for Australian employers interested in workplace health investment figures.

Presenteeism, being present at work while suffering from a health problem that may limit job performance [31], is also linked with negative impacts to productivity and associated costs. Indeed, presenteeism accounts for greater aggregate productivity loss than absenteeism [32–34], thus decreasing worker presenteeism rates will lead to greater savings. Although preliminary evidence has shown that workplace health promotion may be effective at decreasing presenteeism rates [35], there are critical issues surrounding the measurement, conversion and translation of value into economic outcomes [36–38]. It is not the intention of this calculator to overestimate outcomes or in the interest of sustainability of engagement for users to receive an inflated savings figure which may not be realised. For this reason, only business estimates from absenteeism and staff turnover were considered and the most conservative estimates were utilised when average ranges were reported.

The authors further acknowledge that estimating economic savings from productivity loss, even with the exclusion of a measure for presenteeism, remains debatable due to the wide variability, large influence on saving outputs, and issues surrounding use of indirect costs such as double counting and perspective [39]. Therefore the computed savings estimate from the Workplace Health Savings Calculator should not be considered to have utility in a health economic evaluation of workplace health promotion program. It is not an assessment or evaluation tool, rather an engagement tool to support workplace health and wellbeing efforts. The intended design and application is to engage businesses who are seeking an instrument to develop commitment at a stakeholder level.

Furthermore, the Workplace Health Savings Calculator is not a return on investment tool. It does not give the option to quantify program costs and therefore does not estimate net benefits or utilise cost benefit analysis techniques.

The United Kingdom PriceWaterhouseCoopers' review [21] was considered to have a strong methodological approach for the reported business outcomes, with its published effectiveness data also being used to support the Workplace Wellbeing Charter, National Award for England. The authors believe this review represented the best evidence base. In a field known to be lacking in robust quantifiable effectiveness and economic data, the authors recognise the lack of a more scientific approach compromises the validity of the calculator however consider the findings from the case studies to be real world representation and their use in this tool a pragmatic application.

Moreover, the NICE model from where the Workplace Health Savings Calculator was adapted is available as a business case tool within the NICE guidelines [PH13] for promoting physical activity at work. In December 2014 the guidelines underwent a second three-yearly review and the concluding decision states "no new evidence was identified which appeared to contradict the existing recommendations" [40]. Reliability and validity are cornerstone principles to scientific method, and although a gross limitation to the calculator is the fact that neither has been tested, the continued and ongoing expert opinion accepts such limitations due in part to a lack of rigorous evaluation designs, and the complexities and heterogeneities surrounding this public health intervention.

In terms of generalisability, the research evidence used for change estimates was generated from an international (UK) context not an Australian setting where the calculator is applied. It is therefore unknown whether the effect size is transferable to locally-implemented interventions. However, we demonstrated that business sector statistics, workplace health strategies and practices, and the overarching political agenda focused on promoting health in the workplace to address rising prevalence of chronic disease is similar between both countries. Baseline prevalence, characteristics of the target population and capacity to implement interventions are key attributes for transferability in evidence-based public health [41].

From the initial data on organisational profile collected by the online Workplace Health Savings Calculator there has been a large proportion of SME interest. Australia defines a SME as a business employing 0–199 workers (small represents 0–19 employees and medium represents 20–199 employees [24]), and SMEs make up 99.7 % of the Australian business sector [42]. This is comparable in both proportion and definition to United Kingdom, where SMEs are "businesses with zero to 249 employees, (which) account for 99.9 per cent of all enterprises" [43]. Interestingly, of the 55 case studies in the source review, only seven (13 %) were SMEs, representing manufacturing, financial, business services and retail sectors. The approximate size for all other organisations ranged from 200 to 100,000+, the largest being the public sector service organisation. The low representation by small-to-medium business in the review could indicate a general lack of engagement or lack of resources. Nevertheless, in jurisdictions and regions where the business profile differs, for example in Tasmania, Australia (where the vast majority of SMEs are small businesses (94.8 %), with 58.8 % being non-employing businesses and 36 % employing 0–19 workers [42, 44]), a declaration of company size from where estimates originated should be made within the calculator.

Workplace health promotion is a modern corporate strategy, and for countries like Australia, it is a recognised public health initiative aimed at improving employee health and wellbeing. Calculators to assist in business justification are needed to develop stakeholder commitment and are seen as suitable to engage business in conversation for promoting health in the workplace. Other currently available online calculators lack generalisability to the Australian business market. Limitations surround country specificity, currency, complexity and appropriate evidence transferability. In contrast, the Workplace Health Savings Calculator is a practical easy-to-use business case tool that was developed in line with one of the core principles of the National Partnership Agreement on Preventive Health, and is to be used to support, engage and promote the implementation of healthy lifestyle programs in Australian workplaces.

Availability and requirements

Project name: Workplace Health Savings Calculator

Project home page: http://www.healthyworkers.gov.au and direct link available at: http://www.healthyworkers.gov.au/internet/hwi/publishing.nsf/Content/roi-introduction

Operating system(s): Platform independent

Programming language: HTML

Other requirements: Nil

Any restrictions to use by non-academics: None (free to access).

Availability of supporting data

The data supporting the results of this article are included within the article and its additional files.

Abbreviations

SME: Small to medium enterprise; WHO: World Health Organisation; UK: United Kingdom; NICE: National Institute for Health and Clinical Excellence.

Authors' contributions

SB contributed with the development of the calculator and drafted the manuscript. SC assisted with the original policy-level idea, the development of the calculator and helped draft the manuscript. KS contributed with the original idea and assisted with progression and improvements to the calculator development, and helped improve the manuscript. CC assisted with progression of the calculator to the national platform, and helped improve the manuscript. AV contributed to the policy-research partnership (outlined below under Acknowledgements), assisted with improvements to the calculator, and helped improve the manuscript. CO assisted with formation of the policy-research partnership. AP assisted with improvements to the calculator and manuscript. All authors read and approved the final manuscript.

Authors' information

SB is a graduate research PhD candidate, KS is an associate professor, and AV and AP are professors at the Menzies Institute for Medical Research, an institute of the University of Tasmania. They are investigators in a large evaluation known as partneringHealthy@Work, within which the economic case for a workplace health and wellbeing program implemented by the Tasmanian State Government for the Tasmanian public service employees is being assessed. In the Tasmanian Government Department of Health and Human Services, SC is a Healthy Workers Initiative project officer, CC is the Healthy Workers Initiative program manager and CO is the project sponsor and deputy director of Population Health and Wellbeing (within Population Health Services).

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practitioners and policy makers from within the Tasmanian State Government, which was established to evaluate a workplace health promotion program implemented for Tasmanian public service employees. Furthermore the partnership project provided policy-research collaboration between researchers (Menzies Institute for Medical Research) and policy makers within Population Health Services at the Tasmanian Government Department of Health and Human Services. This afforded a three month (100 h) practical placement for one of the partnership PhD students (author SB) to provide additional research resources to the Department of Health and Human Services Healthy Workers Initiative team (authors SC, CC, CO) to assist in the development of the Healthy Workplace Resource Toolkit. Moreover, this placement provided a working example of a public service orientated research-policy alliance for authors SB and SC, and demonstrated a positive example of the value of partnership in translational research. Ethics approval for the student placement was granted by the Social Science Human Research Ethics Committee (Tasmania) Network.

Compliance with ethical guidelines

Competing interests
The authors Siyan Baxter, Sharon Campbell, Kristy Sanderson, Carl Cazaly, Alison Venn, Carole Owen and Andrew Palmer declare that they have no financial competing interests. The tool remains the non-financial intellectual property interest of the University of Tasmania and the Tasmanian Government.

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References

1. Chu C, Breucker G, Harris N, Stitzel A, Gan X, Gu X, Dwyer S. Health-promoting workplaces—international settings development. Health Promot Int. 2000;15(2):155.
2. WHO Global Plan of Action on Workers' Health. http://apps.who.int/gb/ebwha/pdf_files/WHA60/A60_R26-en.pdf (2008–2017). Accessed 17 Apr 2014.
3. The European Network for Health Promotion (ENWHP). http://www.enwhp.org/publications.html. Accessed 10 Apr 2014.
4. Health at work network of the public health responsibility deal. http://www.dh.gov.uk/en/Publichealth/Publichealthresponsibilitydeal/index.htm. Accessed 10 Apr 2014.
5. Department of Health_UK. The NHS Health and Well Being improvement framework, Department of Health. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_128813.pdf (2011). Accessed 5 Dec 2013.
6. National Health Service (NHS). Workplace Wellbeing Charter, National Award for England. http://wellbeingcharter.org.uk. Accessed 5 Dec 2013.
7. Patient Protection and Affordable Care Act 2010. Subtitle D-Provisions Relating to Title IV. HR 3590 EAS/PP. http://www.hhs.gov/healthcare/rights/law/title/iv-amendments.pdf. Accessed 5 Mar 2014.
8. Australian Government Department of Health and Ageing. National Partnership Agreement on Preventive Health (NPAPH). http://www.health.gov.au/internet/main/publishing.nsf/Content/phd-prevention-np. Accessed 11 Oct 2011.
9. World Economic Forum: The New Discipline of Workforce Wellness Enhancing Corportae Performance by Tackling Chronic Disease. 2010.
10. Lerner D, Rodday AM, Cohen JT, Rogers WH. A systematic review of the evidence concerning the economic impact of employee-focused health promotion and wellness programs. J Occup Environ Med. 2013;55(2):209–22.
11. Malik SH, Blake H, Suggs LS. A systematic review of workplace health promotion interventions for increasing physical activity. Br J Health Psychol. 2014;19(1):149–80.
12. Rongen A, Robroek SJW, van Lenthe FJ, Burdorf A. Workplace health promotion: a meta-analysis of effectiveness. Am J Prev Med. 2013;44(4):406–15.
13. Osilla KC, Van Busum K, Schnyer C, Larkin JW, Eibner C, Mattke S. Systematic review of the impact of worksite wellness programs. Am J Manag Care. 2012;18(2):e68–81.
14. Baxter S, Sanderson K, Venn AJ, Blizzard CL, Palmer AJ. The relationship between return on investment and quality of study methodology in workplace health promotion programs. Am J Health Promot. 2014;28(6):347–63.
15. Faragher EB, Cass M, Cooper CL. The relationship between job satisfaction and health: a meta-analysis. Occup Environ Med. 2005;62(2):105–12.
16. Goetzel RZ, Pei X, Tabrizi MJ, Henke RM, Kowlessar N, Nelson CF, Metz RD. Ten modifiable health risk factors are linked to more than one-fifth of employer-employee health care spending. Health Aff Millwood. 2012;31(11):2474–84.
17. Willden M, Schofield G, Duncan S. Establishing links between health and productivity in the New Zealand workforce. J Occup Environ Med. 2012;54(5):545–50.
18. Workplace Well-being Tool. http://www.dwp.gov.uk/health-work-and-well-being/our-work/workplace-well-being-tool/Published. Accessed 8 July 2013.
19. National Institute for Health and Clinical Excellence. Promoting physical activity in the workplace: business case. http://guidance.nice.org.uk/PH13/BusinessCase/xls/English (2008). Accessed 23 Dec 2011.
20. WEF World Economic Forum. Workplace Wellness App developed by Boston Consulting Group. http://wellness.weforum.org/model. Accessed 23 Dec 2011.
21. PricewaterhouseCoopers LLP. Building the case for wellness. London: PWC. http://www.dwp.gov.uk/docs/hwwb-dwp-wellness-report-public.pdf (2008). Accessed 23 Dec 2011.
22. Grossmeier J, Terry PE, Cipriotti A, Burtaine JE. Best practices in evaluating worksite health promotion programs. Am J Health Promot. 2010;24(3):TAHP1–9 [redacted].
23. Australian Government Department of Health and Aging. In: Joint Statement of Commitment: Promoting good heath at work. Canberra, ACT; 2011.
24. Australian Government: Department of Innovation Industry Science and Research: Key statistics: Australian small businesses. Canberra ACT; 2011.
25. Buck Consultants LLP. Working Well: A Global survey of health promotion, workplace wellness and productivity strategies, 6th edn. 2014.
26. Australian Bureau of Statistics. Regional wage and salary earner statistics (Cat. No. 5673.0.55.003). Canberra: ABS; 2008.
27. Australian Human Resources Institute: HR Pulse 2008. 'Love 'em don't lose 'em'—identifying retention strategies that work. In. Melbourne, VICTORIA; 2008. http://www.ahri.com.au/MMSDocuments/profdevelopment/research/research_papers/0803_pulse_vol2_no1_love_em_don't_lose_em_web.pdf.
28. WorkSafe Tasmania. www.worksafe.tas.gov.au/industry_and_safety/health_and_wellbeing/simple_guide_resources. Accessed 17 March 2015.
29. Healthier Workplace WA: Workplace Health Savings Calculator. http://www.healthierworkplacewa.com.au/learn/workplace-health-savings-calculator. Accessed 19 March 2015.
30. Better Work Tasmania: Workplace health and savings calculator. http://www.betterwork.tas.gov.au/membership_benefits_-_public_promotional_information/workplace_health_and_savings_calculator. Accessed 19 March 2015.
31. Schultz AB, Edington DW. Employee health and presenteeism: a systematic review. J Occup Rehabil. 2007;17(3):547–79.
32. Johns G. Presenteeism in the workplace: a review and research agenda. J Organ Behav. 2010;31(4):519–42.
33. Goetzel RZ, Long SR, Ozminkowski RJ, Hawkins K, Wang S, Lynch W. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. J Occup Environ Med. 2004;46(4):398–412.
34. Burton WN, Chen CY, Conti DJ, Schultz AB, Pransky G, Edington DW. The association of health risks with on-the-job productivity. J Occup Environ Med. 2005;47(8):769–77.
35. Cancelliere C, Cassidy JD, Ammendolia C, Cote P. Are workplace health promotion programs effective at improving presenteeism in workers? A systematic review and best evidence synthesis of the literature. BMC public health. 2011;11:395.
36. Brooks A, Hagen SE, Sathyanarayanan S, Schultz AB, Edington DW. Presenteeism: critical issues. J Occup Environ Med. 2010;52(11):1055–67.

37. Koopmanschap M, Burdorf A, Jacob K, Meerding WJ, Brouwer W, Severens H. Measuring productivity changes in economic evaluation: setting the research agenda. Pharmacoeconomics. 2005;23(1):47–54.
38. Zhang W, Bansback N, Anis AH. Measuring and valuing productivity loss due to poor health: a critical review. Soc Sci Med. 2011;72(2):185–92.
39. Drummond MF, Sculpher MJ, Torrance GW. Methods for the economic evaluation of health care programmes. 3rd ed. USA: Oxford University Press; 2005.
40. National Institute for Health and Clinical Excellence: Promoting physical activity in the workplace: review decision document (2014). http://www.nice.org.uk/guidance/ph13/documents. Accessed 14 March 2015.
41. Wang S, Moss JR, Hiller JE. Applicability and transferability of interventions in evidence-based public health. Health Promot Int. 2006;21(1):76–83.
42. Australian Bureau of Statistics. Counts of Australian businesses, including entries and exits, June 2007 until June 2011 (Cat. No. 8165.0). Canberra: ABS; 2012.
43. British Government: Department for Business Innovation and Skills: annual small business survey 2007/08. In: Williams MC editor. Department of Business Enterprise and Regulatory Reform; 2009.
44. Australian Bureau of Statistics. State and territory statistical indicators. Canberra ACT: ABS; 2011.
45. Department of Business Innovation and Skills. Small and medium-sized enterprise (SME) statistics for the UK and regions 2009. London: Government of the United Kingdom; 2010.
46. Australian Bureau of Statistics. Year Book Australia (Cat. No. 1310.0). Canberra ACT: ABS; 2006.
47. Australian Bureau of Statistics. Year Book Australia, Population projections—a tool for examining population ageing (Cat. No. 1301.0). Canberra ACT: ABS; 2008.
48. Australian Bureau of Statistics: Population projections, Australia, 2006 to 2101 (Cat. No. 3222.0). sCanberra, ACT; 2008.
49. Australian Bureau of Statistics. Population projections—a tool for examining population aging (Cat No 1301.1) Year Book Australia. Canberra ACT: ABS; 2008.
50. British Government Department for Work and Pensions: Welfare reform http://www.webarchive.nationalarchives.gov.uk/20130128102031 http://www.dwp.gov.uk/welfarereform/c4.asp (2007).
51. PricewaterhouseCoopers and Medibank Health Solutions: Workplace wellness in Australia, aligning action with aims: Optimising the benefits of workplace wellness. http://www.pwc.com.au (2010).

4 Chapter four: Validation of a preference-based measure of health in the employee population

4.1 Preface

Predominantly, the state of the global economic evidence in workplace health promotion (WHP) measure benefits through productivity savings (mostly from reduced absenteeism) and reduced healthcare costs (refer to Chapter 2 systematic review). The review demonstrates a lack of standardised methods to measure and value such outcomes, with the largest variation seen from the measurement and valuation of indirect costs.

The preceding Chapter 3 concentrated on a partner-defined question to develop a local resource. Absenteeism (an employee's unplanned leave from work, not including other leave such as carer's leave or maternity leave) and staff turnover were used as the key performance estimates within a workplace health savings calculator. This work demonstrated a need for locally-relevant resources for business engagement, despite the lack of methodologically-validated measures in the economic evidence.

Most appropriate and in line with a health economic imperative is the need for identification measurement and valuation of employee health.

This chapter presents a construct validity study of the health state utility value SF-6D, a measure of health status that is amenable to economic evaluations. Validation is investigated using data from the Tasmanian public sector state service workforce Healthy@Work project in addition to Australian general employed and Australian public sector normative samples within the Household Income and Labour Dynamics of Australia survey. It is crucial to identify whether SF-6D values of the Tasmanian State Service (TSS) employees discriminate appropriately between health and socioeconomic factors and work characteristics. Evidence of appropriate discrimination will ensure the SF-6D is measuring what it is supposed to measure. Thus provide confidence in its application in the economic evaluation of Healthy@Work (Chapter 5).

This analysis has been published in *Quality of Life Research* (Appendix 4A).

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4.2 Introduction

For robust health economic evaluations in workplace health promotion to occur, greater attempts are needed to value the health benefits of participating employees. One way for evaluators to achieve this is by incorporating multi-attribute utility instruments (MAUIs) to measure health utility, define benefits in terms of quality adjusted life years (QALYs), and incorporate tariffs (predefined unit prices) to ascertain monetary value. Health economics offers an analytical technique, known as cost utility analysis, to explicitly use health utility to estimate QALYs. Such analyses are rarely conducted in economic evaluations of workplace health promotion.[1] Although the lack of utility data from working populations has likely led to this paucity, perceptions that health utility is not a useful measure within this population may play a part. What is certain is that evidence-based decisions in policy customarily follow economic guidelines,[2] with incremental cost per QALY the gold standard measure of value for money.[3] A greater emphasis to include and measure employee health utility will help inform decisions of resource allocation for workplace health promotion.

Health utilities measure strength of preference for a particular health state and are represented as a number between 0 and 1, with zero equating to death and one equivalent to perfect health. One of several MAUIs, known as SF-6D, derives utility values using Brazier's algorithm,[4,5] from either the SF-12[6] or SF-36[7] health surveys. SF-6D has been subjected to reliability and validity tests in general[8,9] and clinical[10,11] populations with a research application primarily focused on arthritis, muscular skeletal disease, and population norms.[12] Although it is recommended or accepted for use by the pharmacoeconomic guidelines of Ireland, Australia, Italy and Canada, it has not been utilised in occupational studies, whereas the EuroQol EQ-5D, the most widely used MAUI, has been used to quantify the impact of limb injuries in workers[13] and evaluate a workplace physical activity intervention.[14] Studies that have compared SF-6D to EQ-5D have found SF-6D to be more efficient at detecting differences in self-reported health status, more sensitive to change in healthy individuals, less prone to ceiling effects, and to have a normal scaling distribution but lower completion rates and patient acceptability.[15-19] Such evidence suggests SF-6D may be better suited to evaluate respondents in generally healthy populations like the workforce, yet the underlying SF-12 and SF-36 measures are seldom administered to employees; and little is known about the validity of SF-6D in an employed population.

Population norm studies have shown that SF-6D discriminates between gender, age, body mass index (BMI) and educational attainment. On average, females report lower health utility than males, and those with higher educational attainment, lower age and lower BMI have a higher health utility than their counterparts.[8] Studies have also detected differences in health utility in those with risk factors versus established disease.[20] The SF-12 and SF-36 health surveys alone (i.e. when Brazier's algorithm is not applied to derive the SF-6D) measure health-related quality of life (HRQoL). Previous research in working populations using the SF-12 have demonstrated that psychosocial work characteristics such as effort-reward imbalance were associated with perceptions of mental health in German workers[21] and financial workers in Brazil[22] and showed strong association with absenteeism in a German manufacturing plant.[23] A US national cross-sectional study that administered the SF-36 to workers demonstrated that job strain was a significant contributor to HRQoL and warranted consideration as an independent risk factor.[24] The Whitehall II cohort study of British civil servants (men and women) has administered SF-36 five times since 1991. Researchers investigating health and the work environment have demonstrated a strong positive association between employment grade (salary) and HRQoL,[25] and concluded job strain was a predictor for common mental disorders, chronic heart disease and absenteeism.[26]

This study aimed to investigate the construct validity of SF-6D in a large, diverse Australian state service workforce. Employees included senior executives, front line workers, clerical workers, administrators, lawyers, teachers, police, health and emergency personnel, technicians, service providers, labourers, junior graduates and cadets. We examined whether the SF-6D differentiated between participants according to categories of health, socioeconomic and work factors by testing the hypothesis that negative associations would exist for age, BMI, Kessler 10 Psychological Distress Scale (K10), effort-reward imbalance (ERI) and comorbidities, and positive associations would be shown for education and salary. We also examined sex differences. Additionally, we aimed to demonstrate that SF-6D provided preference-based health utilities that reflect working population norms. In so doing we considered the relevance and suitability of SF-6D as a measure of employee health change for use in future economic evaluations of workplace health promotion.

4.3 Methods

4.3.1 Study Population

Data were from the *partnering*Healthy@Work (*p*H@W) study, a 5-year evaluation of a workplace health promotion program delivered to an entire state government workforce in Tasmania, Australia. At baseline (March 2010), a cross-sectional pen and paper questionnaire was delivered by mail to a stratified random sample of adults (n=12,179) representing approximately 40% of the Tasmanian government workforce. The *p*H@W partnership, study population and eligible sample have previously been described.[27] Refer to Chapter 1, 1.7 *partnering*Healthy@Work.

Responders completed the SF-12 by answering questions about their perceived limits due to physical health related to their ability to do moderate activities; to perform in a role at work or other activities; bodily pain; vitality; and their perceived limits due to mental health related to their ability to participate socially; accomplish role-emotional functioning; as well as their feelings of depression. Based on their responses, subjects were assigned an individual health state, of which there were 7500 possibilities within six dimensions; physical functioning, role limitations, social functioning, bodily pain, mental health and vitality. The SF-6D health utility was derived when the individual's health state was subjected to a preference-based scoring algorithm using standard gamble from UK general population norms (Brazier's algorithm).[5] SF-6D yields values between 0.29 and 1, with 1 representing perfect health.[28] There is currently no published SF-6D (SF-12) algorithm for Australia.

Construct validity was tested by correlations and comparisons of mean SF-6D against health, socioeconomic and work characteristics, both internally (*p*H@W) and externally, from an Australian employed normative sample, the Household Income and Labour Dynamics of Australia (HILDA) survey. HILDA is a clustered stratified panel survey of persons residing in private dwellings in Australia which commenced in 2001 and this analysis used SF36 (version 1) data from employed individuals from the 2010 administered self-completion questionnaire which was either collected or returned by mail (n=11,234). SF36 was converted to SF-6D using Brazier's algorithm (model 10).[4] More detailed information on the HILDA survey, the sample and validity of SF-36 have been published previously.[29-31] Evidence suggests both SF-12 and SF-36 generate comparable estimates for SF-6D.[5]

4.3.2 Measures

Age was analysed as a continuous variable for correlations and categorised as 30 or younger, 31-40, 41-50, 51-60, and > 60 to analyse mean SF-6D.

Body mass index (BMI) was derived from self-reported height and weight measures and analysed as a continuous variable and categorised as 24.9, 25-29.9, 30-34.9, 35-39.9 and >40.

Psychological distress was measured using the Kessler Psychological Distress Scale (K10), which identified level of current and depressive symptoms. Ten non-specific psychological distress questions were summed to give a total score between 10 and 50.[32] K10 was analysed as a continuous variable and respondents' psychological distress categorised low (10-15), medium (16-21), high (22-29) or very high (30+). Like the SF-6D, K10 has a 4 week recall period.

Co-morbidities were measured by self-report. Within the *p*H@W questionnaire respondents were asked to report against 23 chronic conditions, including heart conditions, chronic back pain, urinary and gastrointestinal problems, allergies, diabetes, obesity, sleeping problems, fatigue, severe and frequent headaches, cancer, osteoporosis, arthritis and lung problems (including chronic obstructive pulmonary disease, bronchitis or emphysema).[33] Correlations with the number of reported conditions were examined and a count variable was used to further analyse associations of co-morbidity and health utility. This followed guidelines from previous studies using this measure.[34,35] Respondents received either a 0 (no condition reported), a 1 (one condition), 2 (two conditions) and 3+ (if 3 or more conditions were reported). The HILDA survey did not have a comparable measure.

Education was measured in both surveys by respondents' highest attained qualification, and categorised; school-level (primary, year 12 or below); advanced training (trade/apprentice, certificate/diploma); and university (degree, graduate certificate/diploma and post graduate, ie: Masters or PhD).

Employment was categorised three ways; occupational type (blue collar, white collar, service, professional and manager) from the Australian and New Zealand Standard Classification of Occupations (ANZSCO);[36] employment category (permanent or fixed term/casual); and employment condition (full-time or part-time).

Job stress was assessed using the effort-reward imbalance (ERI) instrument, a two-part response consisting of 17 items; 6 items for effort and 11 items for reward.[37] An effort/reward ratio was calculated for each respondent, and further categorised by tertile cut-points representing low, intermediate and high effort-reward imbalance. These were used as a marker of job stress. This measure was only available in the *p*H@W survey.

Socio-economic status was assessed using annual salary and analysed both as a continuous variable and categorised; <$40,000; $40,000-<$60,000; $60,000 –< $80,000; $80,000 –<$100,000; $100,000 –< $120,000; and $120,000+.

Absenteeism was measured using a 4 week recall measure. In the *p*H@W survey "How many days in the last 4 weeks have you stayed away from work for more than half a day because of health problems?" was asked. In HILDA, respondents were asked to record the number of days they had taken paid sick leave in the past 12 months. For comparability, this number was then divided by 12 to derive an average number of days in any 4 week period. Absenteeism was dichotomised; zero days absent in past four weeks (when no days were reported); any days absent in past four weeks (when any number above zero was reported). HILDA respondents reporting a fraction of one day were considered to have zero days absent in the past 4 weeks.

Health behaviour measures included smoking status (respondents were categorised as being a never smoker, ex-smoker or current smoker), physical activity and alcohol risk. Frequency of alcohol intake (typical quantity consumed on a day when drinking) and frequency of heavy drinking (five or more standard drinks on one occasion) were measured using the Alcohol Use Disorders Identification Test (Audit C),[38] which generated scores between 0 and 12. Alcohol risk was coded low (0-6) or high (7 -12) as per the Royal Australian College of General Practitioners (RACGP) guidelines.[39]

Minutes and intensity of physical activity (related to work time, active transport, leisure time, and domestic/gardening activities) undertaken in the past week were assessed using the International Physical Activity Questionnaire (IPAQ-Long) and coded as low, moderate and vigorous activity using standard protocol.[40] Reliability and acceptable validity has been demonstrated.[41,42] Comparable measures for alcohol risk and physical activity were unavailable in HILDA.

4.3.3 Statistical Analysis

The *p*H@W dataset was propensity weighted[43] to account for non-response; the logistic regression model was constructed from employment category, employment condition, agency as well as age, sex and tenure [service length]. Descriptive statistics were presented as mean or percentage (%) (standard error [SE]). Ceiling effects for each of the six SF-6D dimensions were assessed by examination of the proportion of respondents reporting no limitations, and considered present if >15% of participants reported full health (an overall health utility of 1).[18]

To demonstrate construct validity of SF-6D we used Pearson correlation to examine associations between characteristics and measures that theoretically should be convergent: age, BMI, K10, ERI, co-morbidities and salary grade, all stratified by gender. We anticipated high inverse associations, with the exception of salary grade.

We further examined predictors of SF-6D by regressing SF-6D on external factors and health status; age, BMI, co-morbidities, education level, occupational type, employment category, employment condition, salary range, ERI, K10, smoking status, alcohol risk, physical activity and absenteeism. In order to account for variables associated with SF-6D (as defined by their significance (p<0.05) in univariable analysis), we performed both unadjusted and adjusted analyses. In the *p*H@W sample we adjusted for age, BMI, comorbidities, education, employment condition, effort-reward imbalance, K10, smoking status, physical activity, alcohol risk, and absenteeism and for the HILDA samples, BMI, K10, age, occupation, employment condition, salary, smoking status, and absenteeism. We presented both unadjusted and adjusted models for *p*H@W and adjusted for HILDA. To obtain an Australian nationally representative sample for comparison and population-level generalisation, the clustered stratified HILDA dataset was weighted for differential response. Weights were supplied alongside the 2010 data.

All statistical analyses were conducted using STATA© version 12 software package (Statacorp LP, Texas, USA). We assumed statistical significance to be $p<0.05$.

The study was approved by Tasmania Health & Medical Human Research Ethics Committee (EC00337): H0010501

4.4 Results

4.4.1 Characteristics of the study population

Mean age (standard error) of *p*H@W respondents was 45.7 (0.35) for males and 44.5 (0.22) years for females. Most males and females (69%; 61%) were married, with university level education (53%; 55%) and the majority of males (89%) were employed full time. Of the sampling frame (n=27659), 66% were female and of those who returned the questionnaire (n=3408), 72% were female demonstrating that a higher proportion of women participated. Our weighting for non-response accounted for this. The *p*H@W survey had a 24.8% response rate and 98.8% of respondents completed the 7 items of SF-12v2 needed to derive SF-6D. The normative population (n=11234) with its subset sample of public service employees (n=1938) was younger overall (males: 39.7 (14.2), females: 39.2 (13.9)), with the public service marginally older (males: 42.5 (12.8), females: 42.6 (12.2)). Again, both males and females were more often married, in full time employment and public service employees had predominantly attained university level education. A distinction existed in occupational type between samples. While *p*H@W respondents were largely classified white collar or service workers, the Australian normative sample public service were principally classified professional, and there was an even spread for occupational type across the entire sample. Demographic characteristics weighted to population levels are presented in Table 4.1.

Table 4.1 Characteristics of the two study samples: a random sample of an Australian public sector workforce (partneringHealthy@Work) and panel sample of Australian employed from the Household Income and Labour Dynamics of Australia (HILDA) study

		*partnering*Healthy@Work (N=3408)				Australian normative sample (HILDA)							
						All employed (N=11,234)				Public service (N=1938)			
		Females (n=2444)		Males (n=964)		Females (n=5371)		Males (n=5863)		Females(n=1210)		Males (n=728)	
		n	%(SE)	n	%(SE)	n	%(SE)	n	%(SE)	n	%(SE)	n	%(SE)
a)Categorical variables[a]													
Age (years)	30 or younger	266	14(0.8)	74	10(1.1)	1759	32(0.5)	1886	31(0.9)	254	20(2.3)	162	21(1.8)
	31-40	437	20(0.9)	178	21(1.4)	1054	20(0.6)	1212	22(1.0)	244	20(1.8)	157	22(1.8)
	41-50	820	33(1.0)	299	31(1.5)	1268	23(0.6)	1288	22(0.6)	352	29(1.8)	174	25(2.6)
	51-60	799	29(0.9)	342	32(1.5)	957	18(0.7)	1011	17(0.5)	278	24(2.5)	183	26(1.9)
	>60	122	4(0.4)	71	6(0.7)	333	6(0.6)	466	8(0.3)	82	6(2.1)	52	7(1.2)
Marital status	Single	307	14(0.7)	86	10(1.0)	1340	28(1.2)	1484	29(1.0)	202	18(1.6)	125	20(2.2)
	Married	1463	61(1.0)	660	69(1.5)	2458	49(2.7)	2949	52(3.0)	650	57(3.1)	427	61(2.5)
	De facto	304	13(0.7)	114	13(1.1)	966	13(2.6)	1070	13(3.0)	212	13(2.0)	136	15(2.8)
	Separated	258	10(0.6)	73	7(0.8)	527	9(1.5)	329	5(0.9)	137	11(1.6)	36	4(0.8)
	Widowed	55	2(0.3)	6	1(0.2)	75	1(0.3)	25	0(0.1)	8	1(0.4)	3	0(0.3)
Education	School level	537	22(0.8)	166	17(1.2)	2051	38(1.7)	2098	35(1.0)	264	22(1.7)	130	17(2.5)
	Advanced training	567	23(0.9)	291	30(1.5)	1584	29(0.9)	2298	37(0.9)	304	25(1.8)	256	35(2.8)
	University	1308	55(1.0)	495	53(1.6)	1735	33(1.6)	1466	28(1.3)	642	53(2.5)	342	48(4.0)
Occupational type	Blue collar	425	18(0.8)	157	18(1.3)	623	12(0.6)	2598	44(1.0)	70	6(0.9)	142	20(3.6)
	White collar	634	27(0.9)	233	26(1.5)	1936	36(0.7)	747	14(0.7)	246	21(1.5)	82	13(2.1)
	Service	1036	44(1.0)	268	31(1.6)	825	15(0.6)	341	5(0.5)	194	17(1.7)	126	16(2.5)
	Professional	52	2(0.3)	57	7(0.8)	1477	28(1.1)	1189	20(1.0)	612	49(2.1)	291	40(2.2)
	Manager	219	9(0.6)	180	19(1.3)	505	9(1.0)	979	16(0.9)	86	7(1.0)	84	11(1.3)
Employment category	Permanent	2256	92(0.6)	848	87(1.1)	-	-	-	-	-	-	-	-
	Fixed	188	8(0.6)	116	13(1.1)	-	-	-	-	-	-	-	-
Employment condition	Full-time	1243	49(1.0)	814	83(1.3)	2714	51(1.3)	4797	80(1.0)	710	59(1.9)	643	87(3.1)
	Part-time/Casual	1201	51(1.0)	150	17(1.3)	2657	49(1.3)	1066	20(1.0)	500	41(1.9)	85	13(3.1)
Annual salary ($AUD)	<$40,000	155	6(0.5)	71	7(0.8)	434	15(1.0)	684	16(1.2)	20	3(0.7)	10	2(0.9)
	$40-<$60,000	886	37(1.0)	231	26(1.5)	1164	40(1.2)	1210	27(1.2)	312	36(1.7)	142	21(2.7)
	$60-<$80,000	1091	44(1.0)	411	42(1.6)	646	23(1.5)	925	21(1.5)	258	30(1.9)	186	30(3.8)
	$80-<$100,000	256	10(0.6)	172	17(1.2)	344	13(1.0)	615	14(0.9)	177	24(2.2)	165	26(2.6)
	$100-<$120,000	33	1(0.2)	25	2(0.5)	95	4(0.6)	331	7(0.6)	36	4(0.8)	68	11(3.2)
	$120+	23	1(0.2)	54	6(0.7)	133	4(0.5)	648	15(1.1)	26	3(0.8)	74	11(1.9)
Body mass index (BMI) (kg/m^2)	<25	1045	48(1.1)	336	37(1.6)	2333	52(1.0)	1743	37(1.0)	473	45(2.1)	197	29(2.0)
	25-29.9	661	30(1.0)	425	44(1.6)	1218	27(0.9)	2080	42(1.1)	319	31(2.3)	302	46(2.7)
	30-34.9	326	15(0.8)	130	14(1.1)	599	13(0.9)	809	16(1.0)	154	15(2.3)	115	18(2.3)
	35-39.9	118	5(0.5)	36	4(0.6)	243	5(0.4)	193	4(0.4)	68	6(1.0)	28	4(1.1)
	40+	49	2(0.3)	13	1(0.4)	138	3(0.5)	75	2(0.2)	31	2(0.6)	13	2(0.7)
Comorbidities	0	523	26(1.0)	268	33(1.6)	-	-	-	-	-	-	-	-
	1	528	25(1.0)	224	26(1.5)	-	-	-	-	-	-	-	-
	2	395	19(0.9)	156	18(1.3)	-	-	-	-	-	-	-	-

	3+	657	30(1.0)	202	23(1.4)	-	-	-	-	-	-	-	-
Effort-Reward Imbalance (ERI)	Low	752	33(1.0)	317	34(1.6)	-	-	-	-	-	-	-	-
	Middle	787	33(1.0)	325	35(1.6)	-	-	-	-	-	-	-	-
	High	812	34(1.0)	291	31(1.5)	-	-	-	-	-	-	-	-
Psychological distress (K10)	Low	1570	64(1.0)	673	70(1.5)	3059	64(1.4)	3441	68(0.9)	759	67(2.5)	487	72(3.1)
	Moderate	572	24(0.9)	183	20(1.3)	1044	22(1.4)	1024	20(0.8)	233	23(1.9)	129	21(3.0)
	High	194	8(0.6)	80	9(0.9)	466	10(0.8)	405	8(0.5)	86	8(1.7)	39	5(1.0)
	Very High	74	3(0.4)	16	2(0.4)	170	3(0.6)	162	3(0.4)	14	1(0.6)	12	2(0.5)
Smoker	Never	1598	66(1.0)	619	65(1.5)	2769	60(2.4)	2602	54(1.7)	657	62(3.1)	392	58(2.5)
	Ex-daily	614	25(0.9)	243	24(1.4)	1170	24(0.8)	1337	25(0.8)	297	26(1.8)	186	29(1.8)
	Current	223	9(0.6)	99	10(1.0)	796	16(2.0)	1090	21(1.8)	135	12(2.0)	89	13(1.3)
PA (mins/week)[c]	Low	145	6(0.5)	49	5(0.7)	-	-	-	-	-	-	-	-
	Moderate	1032	42(1.0)	365	38(1.6)	-	-	-	-	-	-	-	-
	High	1267	52(1.0)	549	57(1.6)	-	-	-	-	-	-	-	-
Alcohol risk	Low	1354	55(1.0)	471	49(1.6)	-	-	-	-	-	-	-	-
	High	1075	45(1.0)	488	51(1.6)	-	-	-	-	-	-	-	-
Absenteeism[d]	Zero days	1910	78(0.9)	775	80(1.3)	4016	96(0.3)	4387	97(0.3)	870	93(0.9)	547	93(1.2)
	Any day(s)	519	22(0.9)	185	20(1.3)	163	4(0.3)	147	3(0.3)	70	7(0.9)	40	7(1.2)
b) Continuous variables[b]													
		n	mean(SE)	n	mean(SE)	n	mean(SE)	n	mean(SE)	n	mean(SE)	n	mean(SE)
Age (years)		2444	44.5(0.22)	964	45.7(0.35)	5371	39.2(0.18)	5863	39.7(0.17)	1210	42.9(1.16)	728	42.9(0.53)
Annual salary ($AUD)		2444	62,765(403)	964	73,110(1,195)	5371	39,843(815)	5863	58,926(1,343)	1210	53,336(1,095)	728	74,719(1,608)
BMI (kg/m^2)		2199	26.4(0.12)	940	26.9(0.15)	5371	20.7(0.57)	5863	21.3(0.39)	1210	22.0(0.62)	728	24.1(0.87)
Comorbidities (#)		2103	1.9(0.04)	850	1.6(0.06)	-	-	-	-	-	-	-	-
ERI		2351	0.5(0.00)	933	0.4(0.01)	-	-	-	-	-	-	-	-
K10		2410	15.4(0.11)	952	14.7(0.16)	5371	12.7(0.27)	5863	11.7(0.30)	1210	12.5(0.38)	728	12.2(0.58)

[a] criteria used to test discriminate validity

[b] criteria used to test construct validity

[c] denotes Physical Activity, intensity and duration of physical activity during the previous seven days

[d] number of days reported absent from work over a four week period

"-" denotes variable is not available in HILDA

4.4.2 Health utility

SF-6D ranged from 0.357 to 1 in *p*H@W and 0.392 to 1 in the Australian normative sample. Males had a higher mean health utility (0.792 (0.004), 0.792 (0.002), 0.801 (0.005)) than females (0.771 (0.003), 0.775 (0.003), 0.784 (0.004)) across *p*H@W, normative and normative subset samples respectively. Males recorded higher values than females across all categorical variables with the exception of females in *p*H@W whose salary was >$120,000 per annum. In our sample, higher health utility values were seen in employees with lower BMIs, low psychological distress (K10), low effort-reward imbalance, no comorbidities, who reported high physical activity, had the highest salary range, reported zero absenteeism days and were not current smokers. This was reflected in both genders. Health and socioeconomic variables in the normative samples followed trends for BMI, K10, salary range, smoking status and absenteeism (Table 4.2).

Females in *p*H@W who attained a university-level education recorded a lower mean SF-6D (0.765 (0.003), n=1294) than females of school-level education (0.785 (0.006), n=525).The normative subset of public service was in agreement with this finding, 0.781 (0.010), n=585 and 0.793 (0.010), n=224 respectively, for university-educated females and their school-level counterparts.

Older state service employees (age>60) in *p*H@W were found to have the highest health utility for all ages across all samples. The normative public service subset, in all other age categories, reported highest utility values. Age was inversely proportional to utility in the normative population samples; however this association was not seen in *p*H@W (Table 4.2).

Table 4.2 Mean SF-6D health utility by sample characteristics

		*partnering*Healthy@Work (N=3408)						Australian normative sample (HILDA)											
								All employed (N=11,234)						Public service (N=1938)					
		Females(n=2444)			Males (n=964)			Females (n=5371)			Males (n=5863)			Females (n=1210)			Males (n=728)		
		n	mean	se	n	mean	se	n	mean	se	n	mean	se	n	mean	se	n	mean	se
SF-6D health utility score		2409	0.771	0.003	944	0.792	0.004	4639	0.775	0.003	4955	0.792	0.002	1073	0.784	0.004	657	0.801	0.005
Age (years)	30 or younger	264	0.766	0.007	72	0.796	0.013	1456	0.786	0.005	1456	0.805	0.004	213	0.796	0.011	135	0.826	0.019
	31-40	434	0.759	0.006	175	0.785	0.009	911	0.777	0.012	1008	0.793	0.005	219	0.784	0.010	141	0.797	0.009
	41-50	813	0.773	0.004	296	0.792	0.007	1116	0.772	0.005	1122	0.785	0.006	318	0.775	0.009	159	0.792	0.009
	51-60	780	0.776	0.005	334	0.787	0.007	843	0.763	0.008	920	0.784	0.004	244	0.781	0.007	171	0.798	0.008
	>60	119	0.803	0.011	68	0.835	0.013	303	0.765	0.011	427	0.785	0.009	76	0.794	0.014	49	0.789	0.027
BMI (kg/m^2)	< 25	1035	0.782	0.004	330	0.806	0.006	2278	0.786	0.003	1710	0.797	0.004	467	0.799	0.006	197	0.817	0.009
	25-29.9	653	0.776	0.005	417	0.792	0.006	1189	0.774	0.009	2036	0.797	0.004	312	0.780	0.011	295	0.787	0.008
	30-34.9	323	0.753	0.007	127	0.769	0.012	579	0.764	0.006	788	0.785	0.005	147	0.762	0.016	111	0.816	0.014
	35-39.9	116	0.739	0.011	36	0.742	0.018	236	0.740	0.012	183	0.750	0.013	67	0.735	0.026	25	0.778	0.030
	40+	49	0.723	0.021	13	0.806	0.035	135	0.719	0.017	73	0.746	0.029	31	0.772	0.030	13	0.783	0.029
Comorbidities	0	519	0.819	0.005	264	0.825	0.006	-	-	-	-	-	-	-	-	-	-	-	-
	1	526	0.800	0.005	219	0.817	0.008	-	-	-	-	-	-	-	-	-	-	-	-
	2	393	0.775	0.006	153	0.782	0.010	-	-	-	-	-	-	-	-	-	-	-	-
	3+	647	0.715	0.005	197	0.735	0.009	-	-	-	-	-	-	-	-	-	-	-	-
Education	School level	525	0.785	0.006	162	0.800	0.010	1756	0.778	0.003	1695	0.790	0.004	224	0.793	0.01	111	0.802	0.012
	Advanced training	559	0.774	0.005	284	0.787	0.007	1350	0.768	0.009	1940	0.793	0.006	261	0.781	0.02	226	0.805	0.013
	University	1294	0.765	0.003	487	0.792	0.005	1522	0.778	0.004	1297	0.795	0.005	585	0.781	0.01	318	0.798	0.014
Occupational type	Blue collar	418	0.775	0.006	153	0.792	0.010	522	0.756	0.009	2113	0.789	0.003	57	0.765	0.02	122	0.808	0.013
	White collar	626	0.767	0.005	227	0.786	0.008	1672	0.779	0.007	645	0.791	0.01	214	0.776	0.02	77	0.786	0.018
	Service	1022	0.776	0.004	261	0.800	0.007	711	0.769	0.007	293	0.792	0.008	163	0.786	0.01	113	0.809	0.011
	Professional	52	0.765	0.017	57	0.791	0.016	1289	0.781	0.003	1048	0.796	0.005	552	0.788	0.01	266	0.792	0.012
	Manager	216	0.764	0.009	178	0.795	0.009	432	0.777	0.008	826	0.797	0.006	82	0.788	0.01	74	0.833	0.01
Employment category	Permanent	2224	0.771	0.003	830	0.793	0.004	-	-	-	-	-	-	-	-	-	-	-	-
	Fixed/casual	186	0.778	0.009	115	0.784	0.012	-	-	-	-	-	-	-	-	-	-	-	-
Employment condition	Full time	1226	0.766	0.004	796	0.791	0.004	2319	0.778	0.004	4027	0.797	0.002	623	0.781	0.01	582	0.804	0.005
	Part time	1184	0.777	0.004	149	0.794	0.011	2310	0.772	0.004	906	0.775	0.005	447	0.787	0.01	73	0.778	0.018
Salary range ($AUD)	<$40,000	150	0.775	0.011	67	0.794	0.017	363	0.762	0.028	575	0.776	0.005	17	0.812	0.05	9	0.755	0.066
	$40-<$60,000	873	0.775	0.004	226	0.794	0.008	1000	0.779	0.004	1016	0.785	0.006	269	0.788	0.01	127	0.785	0.011
	$60-<$80,000	1078	0.768	0.004	403	0.788	0.006	566	0.779	0.007	791	0.794	0.006	234	0.773	0.01	168	0.793	0.019
	$80-<$100,000	254	0.766	0.008	171	0.790	0.009	307	0.783	0.01	540	0.799	0.006	160	0.779	0.01	150	0.813	0.012
	$100-<$120,000	33	0.782	0.019	25	0.810	0.018	81	0.770	0.021	296	0.821	0.009	34	0.780	0.02	64	0.823	0.019
	$120+	22	0.813	0.021	53	0.807	0.017	115	0.803	0.014	560	0.811	0.009	24	0.810	0.02	69	0.802	0.023

Effort-reward Imbalance (ERI)	Low	746	0.814	0.004	311	0.833	0.006	-	-	-	-	-	-	-	-	-	-	-	-
	Middle	777	0.789	0.004	318	0.803	0.006	-	-	-	-	-	-	-	-	-	-	-	-
	High	800	0.714	0.004	286	0.738	0.007	-	-	-	-	-	-	-	-	-	-	-	-
Psychological distress (K10)	Low	1554	0.823	0.003	662	0.838	0.004	2984	0.819	0.002	3380	0.830	0.002	747	0.820	0.01	480	0.827	0.007
	medium	562	0.704	0.004	178	0.716	0.007	1016	0.731	0.004	993	0.740	0.004	227	0.734	0.01	126	0.758	0.017
	High	190	0.628	0.005	77	0.641	0.009	455	0.663	0.01	390	0.675	0.006	82	0.654	0.02	37	0.660	0.028
	Very high	72	0.584	0.010	16	0.596	0.024	164	0.597	0.01	156	0.619	0.012	14	0.582	0.03	11	0.606	0.031
Smoker	Never	1579	0.773	0.003	607	0.797	0.005	2704	0.782	0.003	2552	0.801	0.004	649	0.792	0.01	384	0.809	0.006
	Ex-daily	604	0.776	0.005	237	0.789	0.008	1135	0.774	0.004	1304	0.787	0.005	288	0.772	0.01	182	0.787	0.010
	Current	218	0.747	0.009	98	0.766	0.011	776	0.752	0.009	1057	0.780	0.005	130	0.765	0.01	87	0.802	0.017
PA (mins/week)[a]	Low	143	0.710	0.011	49	0.743	0.020	-	-	-	-	-	-	-	-	-	-	-	-
	Moderate	1018	0.765	0.004	358	0.783	0.006	-	-	-	-	-	-	-	-	-	-	-	-
	High	1249	0.784	0.003	538	0.802	0.005	-	-	-	-	-	-	-	-	-	-	-	-
Alcohol risk	Low	1335	0.775	0.003	462	0.796	0.006	-	-	-	-	-	-	-	-	-	-	-	-
	High	1060	0.767	0.004	478	0.788	0.005	-	-	-	-	-	-	-	-	-	-	-	-
Absenteeism[b]	Zero days	1885	0.788	0.003	761	0.804	0.004	3489	0.781	0.003	3714	0.795	0.002	776	0.791	0	490	0.808	0.005
	Any day(s)	510	0.713	0.006	180	0.742	0.009	146	0.727	0.015	127	0.748	0.012	62	0.743	0.02	39	0.75	0.023

[a] denotes Physical Activity, intensity and duration of physical activity during the previous seven days

[b] number of days reported absent from work over a four week period

"-" denotes variable is not available in HILDA

4.4.3 Ceiling effect

Within *p*H@W 56 respondents (1.76%) scored 'perfect health' (SF-6D value of 1). A proportion of employees reporting no limitations were seen in all six dimensions, with little gender difference. Ceiling effects occurred in Physical Functioning (84% female, 89% male), Social Functioning (62% female, 68% male), Bodily Pain (57% female, 59% male), and for males in Role Limitations (52%). Ceiling effects were also seen in the normative sample for Social Functioning (59% female, 67% male), Role Limitations (75% female, 81% males), and to a lesser extent in Physical Functioning (51% males) with similar proportions seen in the public service subset (Table 4.3).

Table 4.3 Proportion of respondents (%) reporting no limitations in each of the six dimensions of the SF-6D, stratified by gender

	*partnering*Healthy@Work (N=3,408)				Australian normative sample (HILDA)							
					All employed (N=11,234)				Public service (N=1,938)			
	Females (*n*=2,444)		Males (*n*=964)		Females (*n*=5,371)		Males (*n*=5,863)		Females (*n*=1,210)		Males (*n*=728)	
	n	%	n	%	n	%	n	%	n	%	n	%
Physical functioning	2034	83.6	855	89.0	2183	46.2	2573	51.1	444	40.8	332	49.9
Role limitations	1120	46.2	493	51.5	3527	74.6	4053	80.6	825	76.0	555	83.1
Social functioning	1511	62.1	652	68.1	2788	58.8	3346	66.5	670	61.4	479	71.9
Bodily pain	1380	56.7	564	59.0	1404	29.6	1544	30.6	290	26.6	216	32.4
Mental health	840	34.5	389	40.8	863	18.4	1181	23.7	246	22.6	161	24.3
Vitality	67	2.8	38	4.0	143	4.2	264	7.2	29	3.7	19	3.9

4.4.4 Construct validity

Pearson's correlations demonstrated that SF-6D correlated inversely and most strongly with K10 across all survey samples. The strongest correlation with K10 was seen in *p*H@W (r= -0.63, females; -0.66, males). ERI and comorbidity measures also showed inverse associations (ERI r= -0.37, r= -0.34 and comorbidity r= -0.40 and r= -0.33, females and males respectively). A negative association existed with BMI across all samples and strongest in females (r= -0.11). Age and salary were not correlated with health utility (Table 4.4).

Table 4.4 Pearson's rank correlations of SF-6D health utility with key factors attesting to construct validity

	*partnering*Healthy@Work		Australian normative sample (HILDA)			
	(N=3408)		All employed (N=11,234)		Public service (N=1938)	
	Females	Males	Females	Males	Females	Males
n	1780	773	4629	4933	1070	655
SF-6D	1	1	1	1	1	1
K10	-0.6332*	-0.6585*	-0.612*	-0.598*	-0.6141*	-0.5836*
Age (years)	0.0712*	0.0484	-0.0674*	-0.1065*	-0.0575	-0.1254*
BMI (kg/m^2)	-0.1105*	-0.0918*	-0.0703*	-0.0508*	-0.1096*	-0.0683
Annual salary	0.0045	0.0509	0.0524*	0.1031*	-0.0001	0.0674
Comorbidities	-0.3958*	-0.3318*	-	-	-	-
ERI	-0.3695*	-0.3427*	-	-	-	-
Absenteeism [a]	-0.2539*	-0.2101*	-0.091*	-0.0727*	-0.1159*	-0.1226*

K10 refers to Kessler 10 Psychological Distress Scale

BMI refers to Body Mass Index

ERI refers to Effort-Reward Imbalance, used to assess job stress

* *p* values are statistically significant ($p<0.01$)

[a] Number of days reported absent from work over a four week period

"-" Denotes variable is not available in HILDA

Analysis showing how SF-6D differentiated between health, socioeconomic and work characteristics are presented in Table 4.5 (*p*H@W sample) and Table 4.6 (normative and subset sample). All results presented are adjusted findings. Common to all samples, higher health utility was associated with lower psychological distress ($p<0.01$) and lower absenteeism ($p<0.05$). As measured in *p*H@W, significant negative associations existed for comorbidities and ERI ($p<0.01$), and positive associations for physical activity ($p<0.05$). Females in *p*H@W who had higher educational attainment were more likely to report poorer health utility. An association between SF-6D and occupational type, employment condition, and salary was seen in the general employed, with higher occupational positions (i.e. professionals and managers), full-time employment (in males), and higher salary (in both males and females) associated with higher SF-6D. Both males and females in the general normative sample showed a significant inverse association between SF-6D and age. Although higher BMI was associated with lower health utility, the association was significant only for females in the normative sample. Smoking status exhibited no significant association with SF-6D in any sample.

Table 4.5 Relationship of health, socioeconomic and work characteristics with health utility in partneringHealthy@Work Tasmanian public service employees (N=3,408)

		Unadjusted						Adjusted[a]			
		Females			Males			Females		Males	
Variable		n	β	CI	n	β	CI	β	CI	β	CI
Age (years)	30 or younger	264	ref		72	ref		ref		ref	
	31-40	434	-0.008	(-0.03, 0.01)	175	-0.010	(-0.04, 0.02)	0.004	(-0.01, 0.02)	-0.021	(-0.05, 0.01)
	41-50	813	0.007	(-0.01, 0.02)	296	0.000	(-0.03, 0.03)	0.001	(-0.01, 0.02)	-0.012	(-0.04, 0.01)
	51-60	780	0.009	(-0.01, 0.03)	334	-0.010	(-0.04, 0.02)	0.002	(-0.01, 0.02)	-0.026	(-0.05, 0.00)
	>60	119	0.037	(0.01, 0.06)	68	0.040	(0.00, 0.08)	0.009	(-0.01, 0.03)	-0.001	(-0.03, 0.03)
	p		***p*<0.05***			0.305		0.460		0.960	
BMI (kg/m^2)	< 25	1035	ref		330	ref		ref		ref	
	25-29.9	653	-0.006	(-0.02, 0.01)	417	-0.010	(-0.03, 0.00)	-0.003	(-0.01, 0.01)	0.007	(-0.01, 0.02)
	30-34.9	323	-0.030	(-0.05, -0.01)	127	-0.040	(-0.06, -0.01)	-0.006	(-0.02, 0.01)	-0.004	(-0.03, 0.02)
	35-39.9	116	-0.044	(-0.07, -0.02)	36	-0.060	(-0.10, -0.03)	-0.011	(-0.03, 0.01)	-0.016	(-0.05, 0.02)
	40+	49	-0.060	(-0.10, -0.02)	13	0.000	(-0.07, 0.07)	0.013	(-0.02, 0.04)	0.022	(-0.03, 0.07)
	p		***p*<0.05***			***p*<0.05***		0.381		0.392	
Comorbidities	0	519	ref		264	ref		ref		ref	
	1	526	-0.020	(-0.03, -0.01)	219	-0.010	(-0.03, 0.01)	-0.011	(-0.02, 0.00)	-0.013	(-0.03, 0.00)
	2	393	-0.045	(-0.06, -0.03)	153	-0.040	(-0.07, -0.02)	-0.022	(-0.03, -0.01)	-0.012	(-0.03, 0.01)
	3+	647	-0.105	(-0.12, -0.09)	197	-0.090	(-0.11, -0.07)	-0.052	(-0.07, -0.04)	-0.033	(-0.05, -0.02)
	p		***p*<0.05***			***p*<0.05***		***p*<0.05***		***p*<0.05***	
Education	School level	525	ref		162	ref		ref		ref	
	Advanced training	559	-0.012	(-0.03, 0.00)	284	-0.010	(-0.04, 0.01)	-0.005	(-0.02, 0.01)	-0.008	(-0.03, 0.01)
	University	1294	-0.020	(-0.03, -0.01)	487	-0.010	(-0.03, 0.02)	-0.015	(-0.03, 0.00)	-0.004	(-0.02, 0.01)
	p		***p*<0.05***			0.699		***p*<0.05**		0.684	
Occupational type	Blue collar	418	ref		153	ref		ref		ref	
	White collar	626	-0.007	(-0.02, 0.01)	227	-0.010	(-0.03, 0.02)	-0.004	(-0.02, 0.01)	0.001	(-0.02, 0.02)
	Service	1022	0.002	(-0.01, 0.02)	261	0.010	(-0.02, 0.03)	0.013	(0.00, 0.03)	0.009	(-0.01, 0.03)
	Professional	52	-0.010	(-0.05, 0.03)	57	0.000	(-0.04, 0.04)	0.023	(-0.01, 0.06)	0.010	(-0.02, 0.04)
	Manager	216	-0.011	(-0.03, 0.01)	178	0.000	(-0.02, 0.03)	0.005	(-0.02, 0.03)	-0.001	(-0.03, 0.02)
	p		0.691			0.577		0.225		0.886	
Employment category	Permanent	2224	ref		830	ref		ref		ref	
	Fixed/casual	186	0.007	(-0.01, 0.03)	115	-0.009	(-0.03, 0.02)	0.013	(0.00, 0.03)	-0.001	(-0.02, 0.02)
	p		0.453			0.454		0.104		0.908	
Employment condition	Full time	1226	ref		796	ref		ref		ref	
	Part time	1184	0.011	(0.00, 0.02)	149	0.003	(-0.02, 0.03)	0.000	(-0.01, 0.01)	0.006	(-0.01, 0.02)
	p		***p*<0.05**			0.810		0.910		0.549	
Salary range	<$40,000	150	ref		67	ref		ref		ref	

	$40-<$60,000	873	0.000	(-0.02, 0.02)	226	0.000	(-0.04, 0.04)	0.006	(-0.02, 0.03)	0.005	(-0.02, 0.04)
	$60-<$80,000	1078	-0.007	(-0.03, 0.02)	403	-0.006	(-0.04, 0.03)	0.011	(-0.01, 0.04)	0.000	(-0.03, 0.03)
	$80-<$100,000	254	-0.008	(-0.04, 0.02)	171	-0.005	(-0.04, 0.03)	0.008	(-0.02, 0.04)	-0.007	(-0.04, 0.03)
	$100-<$120,000	33	0.007	(-0.04, 0.05)	25	0.015	(-0.03, 0.06)	0.030	(-0.02, 0.08)	0.000	(-0.05, 0.05)
	$120+	22	0.038	(-0.01, 0.08)	53	0.013	(-0.03, 0.06)	0.021	(-0.03, 0.07)	0.020	(-0.02, 0.06)
	p		0.714			0.651		0.298		0.671	
Effort-Reward Imbalance (ERI)	Low	746	ref		311	ref		ref		ref	
	Middle	777	-0.025	(-0.04, -0.01)	318	-0.030	(-0.05, -0.01)	-0.015	(-0.03, -0.01)	-0.016	(-0.03, 0.00)
	High	800	-0.100	(-0.11, -0.09)	286	-0.095	(-0.11, -0.08)	-0.038	(-0.05, -0.03)	-0.040	(-0.06, -0.02)
	p		***p*<0.05***			***p*<0.05***		***p*<0.05***		***p*<0.05***	
Psychological distress (K10)	Low	1554	ref		662	ref		ref		ref	
	medium	562	-0.120	(-0.13, -0.11)	178	-0.122	(-0.14, -0.11)	-0.098	(-0.11, -0.09)	-0.109	(-0.13, -0.09)
	High	190	-0.196	(-0.21, -0.19)	77	-0.196	(-0.22, -0.18)	-0.164	(-0.18, -0.15)	-0.175	(-0.20, -0.15)
	Very high	72	-0.240	(-0.26, -0.22)	16	-0.241	(-0.29, -0.19)	-0.192	(-0.21, -0.17)	-0.208	(-0.28, -0.14)
	p		***p*<0.05***			***p*<0.05***		***p*<0.05***		***p*<0.05***	
Smoker	Never	1579	ref		607	ref		ref		ref	
	Ex-daily	604	0.002	(-0.01, 0.01)	237	-0.008	(-0.03, 0.01)	0.000	(-0.01, 0.01)	0.010	(-0.01, 0.03)
	Current	218	-0.026	(-0.04, -0.01)	98	-0.031	(-0.06, -0.01)	-0.009	(-0.02, 0.01)	-0.017	(-0.04, 0.01)
	p		***p*<0.05**			***p*<0.05**		0.253		0.169	
PA (mins/week)[b]	Low	143	ref		49	ref		ref		ref	
	Moderate	1018	0.055	(0.03, 0.08)	358	0.039	(0.00, 0.08)	0.024	(0.00, 0.04)	0.025	(-0.01, 0.06)
	High	1249	0.074	(0.05, 0.10)	538	0.059	(0.02, 0.10)	0.037	(0.02, 0.06)	0.031	(0.00, 0.06)
	p		***p*<0.05***			***p*<0.05***		***p*<0.05***		0.062	
Alcohol risk	Low	1335	ref		462	ref		ref		ref	
	High	1060	-0.008	(-0.02, 0.00)	478	-0.008	(-0.02, 0.01)	0.006	(0.00, 0.01)	-0.003	(-0.02, 0.01)
	p		0.112			0.330		0.180		0.655	
Absenteeism[c]	Zero days	1885	ref		761	ref		ref		ref	
	Any day(s)	510	-0.075	(-0.09, -0.06)	180	-0.063	(-0.08, -0.04)	-0.025	(-0.04, -0.01)	-0.027	(-0.05, -0.01)
	p		***p*<0.05***			***p*<0.05***		***p*<0.05***		***p*<0.05***	

***p* denotes linear trend, bold *p* values are statistically significant (*p*<0.05)**

*** *p* values are statistically significant (*p*<0.01)**

[a] Adjusted for age, BMI, comorbidities, education, employment condition, ERI, K10, smoking status, physical activity, absenteeism

[b] denotes Physical Activity, intensity and duration of physical activity during the previous seven days

[c] number of days reported absent from work over a four week period

Table 4.6 Relationship of health, socioeconomic and work characteristics with health utility in employees and the public service subset of the Household Income and Labour Dynamics of Australia survey (HILDA)a

		All employed (N=11,234)						Public service (N=1,938)					
		Females			Males			Females			Males		
		n	β	CI	n	β	CI	n	β	CI	n	β	CI
Age (years)	*30 or younger	1759	Ref		1886	Ref		254	Ref		162	Ref	
	31-40	1054	-0.008	(-0.02, 0.004)	1212	-0.020	(-0.036, -0.004)	244	0.005	(-0.019, 0.028)	157	-0.028	(-0.062, 0.006)
	41-50	1268	-0.015	(-0.031, 0)	1288	-0.032	(-0.046, -0.018)	352	-0.009	(-0.034, 0.016)	174	-0.049	(-0.08, -0.018)
	51-60	957	-0.030	(-0.043, -0.017)	1011	-0.039	(-0.053, -0.024)	278	-0.009	(-0.033, 0.014)	183	-0.039	(-0.072, -0.007)
	>60	333	-0.034	(-0.055, -0.012)	466	-0.041	(-0.058, -0.024)	82	-0.015	(-0.038, 0.008)	52	-0.069	(-0.116, -0.022)
	p		***p*<0.05***			***p*<0.05***			0.202			***p*<0.05***	
BMI (kg/m^2)	< 25	2333	Ref		1743	Ref		473	Ref		197	Ref	
	25-29.9	1218	-0.009	(-0.021, 0.003)	2080	-0.008	(-0.017, 0)	319	-0.001	(-0.021, 0.019)	302	-0.014	(-0.037, 0.008)
	30-34.9	599	-0.024	(-0.038, -0.01)	809	-0.006	(-0.015, 0.003)	154	-0.031	(-0.056, -0.007)	115	0.002	(-0.022, 0.026)
	35-39.9	243	-0.032	(-0.056, -0.008)	193	-0.030	(-0.05, -0.01)	68	-0.017	(-0.049, 0.015)	28	-0.019	(-0.066, 0.028)
	40+	138	-0.045	(-0.074, -0.015)	75	-0.028	(-0.058, 0.002)	31	0.003	(-0.042, 0.048)	13	-0.029	(-0.082, 0.025)
	p		***p*<0.05***			0.067			0.887			0.289	
Education	School level	2051	Ref		2098	Ref		264	Ref		130	Ref	
	Advanced training	1991	0.002	(-0.012, 0.016)	2601	0.004	(-0.005, 0.013)	472	0.011	(-0.015, 0.036)	342	0.006	(-0.019, 0.031)
	University	1328	-0.005	(-0.022, 0.011)	1163	0.005	(-0.009, 0.018)	474	0.004	(-0.026, 0.034)	256	0.000	(-0.027, 0.028)
	p		0.521			0.445			0.988			0.928	
Occupational type	Blue collar	623	Ref		2598	Ref		70	Ref		142	Ref	
	White collar	1936	-0.002	(-0.023, 0.018)	747	0.015	(0.003, 0.026)	246	-0.003	(-0.054, 0.049)	82	-0.010	(-0.044, 0.024)
	Service	825	0.004	(-0.02, 0.029)	341	0.007	(-0.012, 0.026)	194	-0.007	(-0.065, 0.052)	126	-0.009	(-0.041, 0.024)
	Professional	1477	-0.004	(-0.022, 0.014)	1189	0.002	(-0.008, 0.013)	612	-0.011	(-0.057, 0.036)	291	-0.016	(-0.045, 0.012)
	Manager	505	-0.020	(-0.044, 0.004)	979	0.015	(0.005, 0.024)	86	-0.022	(-0.074, 0.03)	84	0.008	(-0.023, 0.04)
	p		0.096			***p*<0.05***			0.396			0.597	
Employment condition	Full time	2714	Ref		4797	Ref		710	Ref		643	Ref	
	Part time	2657	-0.009	(-0.019, 0.001)	1066	-0.020	(-0.037, -0.003)	500	-0.003	(-0.025, 0.018)	85	-0.024	(-0.1, 0.053)
	p		0.067			***p*<0.05**			0.754			0.537	
Salary range	<$40,000	434	Ref		684	Ref		20	Ref		10	Ref	
	$40-<$60,000	1164	0.017	(-0.003, 0.037)	1210	0.007	(-0.006, 0.019)	312	-0.036	(-0.091, 0.019)	142	-0.047	(-0.179, 0.086)
	$60-<$80,000	646	0.017	(-0.006, 0.04)	925	0.009	(-0.002, 0.019)	258	-0.037	(-0.1, 0.026)	186	-0.034	(-0.162, 0.094)
	$80-<$100,000	344	0.024	(-0.005, 0.052)	615	0.008	(-0.008, 0.024)	177	-0.029	(-0.095, 0.036)	165	-0.025	(-0.151, 0.101)
	$100-<$120,000	95	0.027	(-0.011, 0.065)	331	0.023	(0.008, 0.039)	36	-0.046	(-0.111, 0.02)	68	-0.036	(-0.175, 0.103)
	$120+	108	0.029	(0.004, 0.055)	564	0.022	(0.009, 0.035)	26	-0.025	(-0.088, 0.039)	74	-0.024	(-0.154, 0.106)
	p		***p*<0.05**			***p*<0.05***			0.442			0.706	
Psychological distress (K10)	Low	3059	Ref		3441	Ref		759	Ref		487	Ref	

	Medium	1044	-0.088	(-0.099, -0.076)	1024	-0.086	(-0.098, -0.075)	233	-0.094	(-0.116, -0.071)	129	-0.074	(-0.102, -0.046)
	High	466	-0.145	(-0.167, -0.124)	405	-0.161	(-0.178, -0.144)	86	-0.140	(-0.184, -0.097)	39	-0.164	(-0.219, -0.109)
	Very high	170	-0.217	(-0.259, -0.176)	162	-0.194	(-0.228, -0.16)	14	-0.208	(-0.238, -0.178)	12	-0.213	(-0.282, -0.144)
	p		**p<0.05***			**p<0.05***			**p<0.05***			**p<0.05***	
Smoking	Never	2769	Ref		2602	Ref		657	Ref		392	Ref	
	Ex-daily	1170	0.000	(-0.009, 0.01)	1337	-0.004	(-0.013, 0.004)	297	-0.004	(-0.022, 0.015)	186	-0.015	(-0.037, 0.006)
	Current	796	-0.005	(-0.02, 0.009)	1090	-0.007	(-0.018, 0.003)	135	0.000	(-0.027, 0.028)	89	0.004	(-0.024, 0.033)
	p		0.466			0.168			0.992			0.759	
Absenteeism[b]	No days	4016	Ref		4387	Ref		870	Ref		547	Ref	
	Any days	163	-0.042	(-0.067, -0.017)	147	-0.027	(-0.048, -0.006)	70	-0.048	(-0.078, -0.018)	40	-0.014	(-0.051, 0.023)
	p		**p<0.05***			**p<0.05**			**p<0.05***			0.443	

***p* denotes linear trend, bold *p* values are statistically significant (*p*<0.05)**

*** *p* values are statistically significant (*p*<0.01)**

[a]Model presented is adjusted for age, BMI, employment condition, occupation type, K10, salary, smoking status, absenteeism

[b]Number of days reported absent from work over a four week period

4.5 Discussion

The present study examined the construct validity of SF-6D in a population of state service employees (*p*H@W), and compared findings with an Australian normative employed sample and public service subset. For both males and females, psychological distress (K10), comorbidity and job stress (ERI) had the strongest negative association with health utility. The normative sample also demonstrated significant negative associations between SF-6D and K10 in addition to age and BMI (in female workers). Additionally, the normative general employed showed a significant positive association with salary, which was not reflected in state or public service employees.

We found mean health utility differed by gender and was higher in males than females across all samples. The existence of gender difference is consistent with prior research.[8,15,35,44] Overall mean health utility was higher than the equivalent Australian population norms derived from SF-36.[8] Considerable evidence in the occupational literature demonstrates those in the workforce, more than the general population, experience higher health functionality by the very nature of being able to work, or indeed as a result of working, a phenomenon known as the healthy worker effect[45,46] This effect could explain the lack of association with age in *p*H@W with workers over age 60 showing relatively favourable health utilities possibly due to early retirement for those in poorer health or study selection bias not replicated in the normative samples. Although our overall mean values are lower than another Australian population norm study[35] where authors derived health utility using another MAUI known as Australian Quality of Life (AQoL), it has been shown that different instruments produce different utility values.[47]

Results demonstrated that females who had a university level education experienced a significantly poorer health state than their school-level counterparts. This finding was not supported in the normative working sample or literature and could indicate either a real effect specific to this population, selection bias or confounding due to factors not measured in *p*H@W.

Psychological distress, job stress and existing medical conditions more so than health factors (physical inactivity, high alcohol risk and smoking) negatively impacted employee health utility. The high correlation with psychological distress (-0.66; -0.63 males: females) may indicate there is significantly greater impairment due to employee mental health issues, which aligns with findings from a study of HRQoL that showed mental more than physical health has greater impact.[48] In a recent Delphi–procedure undertaken to identify core domains of health utility scales, mental and social domains were considered more essential than physical domains.[49] Previous studies investigating work stress using the ERI measure confirm high job stress has a negative relationship with employee health.[21,50,51] Moreover, a recent study of male automotive assembly workers found working conditions (job demand, job control and social support) increased self-perceived stress and decreased self-perceived quality of life.[52] In summary, our findings suggest employee psychological distress and perception of job stress are important correlates of employee health utility, and occupational studies could include SF-6D as an outcome to investigate causality.

Appropriateness of SF-6D use was considered by examining ceiling effects, first, by investigating respondent proportions clustered at "no limitations" within dimensions, and second, by overall percentage who reported a value of 1 (perfect health). Our evidence demonstrated high proportions in four of six dimensions, a finding congruent with the functioning productive nature of the employed, as opposed to SF-6D's inability to detect health state variability. Overall, 1.76% of *p*H@W respondents scored "perfect health". This indicated SF-6D does not over predict better health states nor suffer from a ceiling effect in this occupational sample. It is known that clustering at 'no limitations" occurs in these types of measures; however, published articles focusing on other populations demonstrate that SF-6D suffers less from a ceiling effect than the EQ-5D.[10,17,18] Therefore, although EQ-5D tends to dominate in economic evaluations (66% over other MAUIs[12]) SF-6D may play a more important role for evaluating respondents in generally healthy populations like the workforce.

There are limitations to our study. First, the lack of an additional health utility measure alongside SF-6D in the *p*H@W questionnaire impeded further analyses of validity. Thus important questions concerning whether utility values for SF-6D would be lower or higher than AQoL values when measured in an employee population (as the normative AQoL study demonstrated higher values [35]) cannot be answered. The extent to which this would add validity is questionable considering a recent finding relating to the comparison of utility values across MAUIs has indicated a dissimilar distribution and difference in mean scores between results.[18,47] Second, the low response rate (24.8%) could have affected generalisability of the overall results and to other working populations. In the attempt to minimise this implication propensity weighting for non-response was utilised, the work undertaken across *p*H@W state sector was considered diverse, and we demonstrated our findings were translatable to other business sectors by external validation of a working population normative sample. Finally, no attempt was made to infer causation, missing data from survey participants was low (<3%), and every effort was made to use well-validated measures in the survey design to ensure highest possible data quality and accuracy of results.

Strength was in our ability to accurately examine health utility against a comparable 4 week recall of absenteeism. The significant association found between SF-6D and absenteeism across all samples warrants particular attention. The possible predictive nature of SF-6D on workplace performance indicators will be of paramount importance if in fact SF-6D is found to be a proxy measure for indirect costs of productivity loss in the workplace.

Our study provides insight into the validity of SF-6D as a measure of health utility in the Tasmanian state service employees. We demonstrated that the derived preference-based SF-6D health utility offered a level of interpretation and discrimination through expected correlations with socioeconomic, work factors and health status in a population of employees, in addition to external validation from a normative working population sample.

Due to its capability and in recognition that the SF-6D has shown sensitivity to change in clinical settings,[53,54] and is more sensitive to detecting small changes in relatively healthy individuals,[19,35] we suggest SF-6D is a valid instrument for measuring employee health changes resulting from workplace health promotion programs. Fundamentally, SF-6D offers capability to place value on employee health outcomes in economic evaluations of workplace health interventions.

4.6 Acknowledgements

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4.7 Summary

Health utility values permit cost utility analysis in workplace health promotion however utility measures of working populations have not been validated.

Purpose: To investigate construct validity of SF-6D health utility in a public sector state service workforce.

Methods: SF-12v2 Health Survey was administered to 3408 randomly selected public service employees in Australia in 2010. SF-12 scores were converted to SF-6D health utility values. Associations and correlates of SF-6D with health, socio-demographic and work characteristics [co-morbidities, body mass index (BMI), Kessler-10 psychological distress (K10), education, salary, effort-reward imbalance (ERI), and absenteeism] were explored. Ceiling effects were analysed. Nationally representative employee SF-6D values from the Household, Income and Labour Dynamics in Australia (HILDA) survey (n=11234) were compared. All analyses were stratified by sex.

Results: Mean (SE) age was 45.7 (0.35) males; 44.5 (0.22) females. Females represented 72% of the sample. Mean (SE) health utility 0.792 (0.004); 0.771 (0.003) was higher in males. SF-6D demonstrated both a significant inverse association ($p<0.01$) and negative correlations (female; male) with K10 ($r= -0.63$; $r= -0.66$), comorbidity count ($r= -0.40$; $r= -0.33$), ERI ($r= -0.37$; $r= -0.34$) and absenteeism ($p<0.005$, $r= -0.25$; $r= -0.21$). Mean (SE) SF-6D in HILDA was 0.792 (0.002); 0.775 (0.003) males; females. Correlates and associations in all samples were similar. The general employed demonstrated a significant inverse association with age and positive association with salary. SF-6D was independent of BMI.

Conclusions: Psychological distress, comorbidity, effort-reward imbalance and absenteeism are negatively associated with employee health. SF-6D is a valid measure of perceived health states in working populations.

4.8 Postscript

This analysis met the identified need for broader measures of health to be available for economic evaluations in WHP. It demonstrated the construct validity of a measure of health utility (SF-6D) in the employee population. SF-6D health utility is a single index of health status. It reflects people's preference for different health states using preference scores based on community-derived weights. The analysis found worker SF-6D health utility values appropriately measured across gender and appropriately discriminated between health factors (comorbidity, body mass index, psychological distress, age), socioeconomic factors (salary, in populations within private enterprise), and work characteristics (job stress, absenteeism, employment condition and occupational type). Furthermore SF-6D did not demonstrate a ceiling effect in the working population.

This result can support better economic methodology in workplace health promotion through provision of a valid measure of health status that is sensitive in a generally healthy population and that is amenable to economic evaluations. Specifically, this analysis assists to define employee health so that impacts on health can be assessed, provides a measure that places value on health, and offers a valuation option for those who may wish to align workplace health promotion intervention evaluations with policy guidelines and the presentation of quality adjusted life years.

4.9 References

1. Baxter S, Sanderson K, Venn AJ, Blizzard CL, Palmer AJ. The relationship between return on investment and quality of study methodology in workplace health promotion programs. *Am. J. Health Promot.* 2014;28(6):347-363.
2. Shemilt I MM, Vale L, Marsh K, Donaldson C (editors). *Evidence-based decisions and economics : health care, social welfare, education and criminal justice.* 2nd ed. Chichester, West Sussex, UK ; Hoboken, NJ: Wiley-Blackwell/BMJ Books; 2010.
3. Drummond MF, Sculpher MJ, Torrance GW. *Methods for the economic evaluation of health care programmes 3rd edition.* Oxford University Press, USA; 2005.
4. Brazier J, Roberts J, Deverill M. The estimation of a preference-based measure of health from the SF-36. *J. Health Econ.* Mar 2002;21(2):271-292.
5. Brazier JE, Roberts J. The estimation of a preference-based measure of health from the SF-12. *Med. Care.* 2004;42(9):851-859.
6. Ware Jr JE, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Med. Care.* 1996;34(3):220-233.
7. Ware Jr JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Med. Care.* 1992;30(6):473-483.
8. Norman R, Church J, van den Berg B, Goodall S. Australian health-related quality of life population norms derived from the SF-6D. *Aust. N. Z. J. Public Health.* 2013;37(1):17-23.
9. Lam CL, Brazier J, McGhee SM. Valuation of the SF-6D health states is feasible, acceptable, reliable, and valid in a Chinese population. *Value in Health.* 2008;11(2):295-303.
10. Marra CA, Woolcott JC, Kopec JA, et al. A comparison of generic, indirect utility measures (the HUI2, HUI3, SF-6D, and the EQ-5D) and disease-specific instruments (the RAQoL and the HAQ) in rheumatoid arthritis. *Soc. Sci. Med.* 2005;60(7):1571-1582.
11. Khanna D, Furst DE, Wong WK, et al. Reliability, validity, and minimally important differences of the SF-6D in systemic sclerosis. *Qual. Life Res.* 2007;16(6):1083-1092.
12. Richardson J MJ, Bariola E.,. Review and Critique of Health Related Multi Attribute Utility Instruments In: Culyer A, editor.Encyclopedia of health economics. San Diego: Elsevier Science; in press. Available from: http://www.buseco.monash.edu.au/centres/che/pubs/researchpaper64.pdf. 2011.
13. Hou WH, Liang HW, Hsieh CL, Sheu CF, Hwang JS, Chuang HY. Integrating health-related quality of life with sickness leave days for return-to-work assessment in traumatic limb injuries. *Qual. Life Res.* Nov 2013;22(9):2307-2314.
14. McEachan RR, Lawton RJ, Jackson C, Conner M, Meads DM, West RM. Testing a workplace physical activity intervention: a cluster randomized controlled trial. *Int J Behav Nutr Phys Act.* 2011;8:29.
15. Petrou S, Hockley C. An investigation into the empirical validity of the EQ-5D and

SF-6D based on hypothetical preferences in a general population. *Health Econ.* 2005;14(11):1169-1189.

16. Barton GR, Sach TH, Avery AJ, et al. A comparison of the performance of the EQ-5D and SF-6D for individuals aged >or= 45 years. *Health Econ.* Jul 2008;17(7):815-832.
17. Brazier J, Roberts J, Tsuchiya A, Busschbach J. A comparison of the EQ-5D and SF-6D across seven patient groups. *Health Econ.* 2004;13(9):873-884.
18. Leung YY, Png ME, Wee HL, Thumboo J. Comparison of EuroQol-5D and short form-6D utility scores in multiethnic Asian patients with psoriatic arthritis: a cross-sectional study. *J. Rheumatol.* Jun 2013;40(6):859-865.
19. Longworth L, Bryan S. An empirical comparison of EQ-5D and SF-6D in liver transplant patients. *Health Econ.* 2003;12(12):1061-1067.
20. Franks P, Hanmer J, Fryback DG. Relative disutilities of 47 risk factors and conditions assessed with seven preference-based health status measures in a national U.S. sample: toward consistency in cost-effectiveness analyses. *Med. Care.* May 2006;44(5):478-485.
21. Kudielka BM, Hanebuth D, von Kanel R, Gander ML, Grande G, Fischer JE. Health-related quality of life measured by the SF12 in working populations: associations with psychosocial work characteristics. *J. Occup. Health Psychol.* Oct 2005;10(4):429-440.
22. Silva LS, Barreto SM. Adverse psychosocial working conditions and poor quality of life among financial service employees in Brazil. *J Occup Health.* 2012;54(2):88-95.
23. Hanebuth D, Meinel M, Fischer JE. Health-related quality of life, psychosocial work conditions, and absenteeism in an industrial sample of blue- and white-collar employees: a comparison of potential predictors. *J. Occup. Environ. Med.* Jan 2006;48(1):28-37.
24. Lerner DJ, Levine S, Malspeis S, D'Agostino RB. Job strain and health-related quality of life in a national sample. *Am. J. Public Health.* 1994;84(10):1580-1585.
25. Hemingway H, Nicholson A, Stafford M, Roberts R, Marmot M. The impact of socioeconomic status on health functioning as assessed by the SF-36 questionnaire: the Whitehall II Study. *Am. J. Public Health.* Sep 1997;87(9):1484-1490.
26. Marmot M, Brunner E. Cohort profile: the Whitehall II study. *Int. J. Epidemiol.* 2005;34(2):251-256.
27. Kilpatrick M, Sanderson K, Blizzard L, Teale B, Venn A. Cross-sectional associations between sitting at work and psychological distress: reducing sitting time may benefit mental health. *Mental Health and Physical Activity.* 2013;6:103-109.
28. Walters SJ, Brazier JE. Comparison of the minimally important difference for two health state utility measures: EQ-5D and SF-6D. *Qual. Life Res.* Aug 2005;14(6):1523-1532.
29. Wooden M, Watson N. The HILDA Survey and its Contribution to Economic and Social Research (So Far)*. *Econ. Rec.* 2007;83(261):208-231.
30. Watson N, Wooden M. The HILDA Survey four years on. *Australian Econ. Rev.*

2004;37(3):343-349.

31. Watson WL, Ozanne-Smith J, Richardson J. An evaluation of the assessment of quality of life utility instrument as a measure of the impact of injury on health-related quality of life. *International Journal of Injury Control and Safety Promotion.* 2005;12(4):227-239.

32. Kessler RC, Andrews G, Colpe LJ, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol. Med.* 2002;32(6):959-976.

33. Kessler RC, Barber C, Beck A, et al. The world health organization health and work performance questionnaire (HPQ). *J. Occup. Environ. Med.* 2003;45(2):156-174.

34. Kessler RC, Ames M, Hymel PA, et al. Using the World Health Organization Health and Work Performance Questionnaire (HPQ) to evaluate the indirect workplace costs of illness. *J. Occup. Environ. Med.* Jun 2004;46(6):S23-S37.

35. Hawthorne G, Korn S, Richardson J. Population norms for the AQoL derived from the 2007 Australian National Survey of Mental Health and Wellbeing. *Aust. N. Z. J. Public Health.* Feb 2013;37(1):7-16.

36. ANZSCO. Australian and New Zealand Standard Classification of Occupations (ANZSCO), First edition, 2006 (ABS Cat. No. 1220.0). 2006.

37. Siegrist J, Starke D, Chandola T, et al. The measurement of effort–reward imbalance at work: European comparisons. *Soc. Sci. Med.* 2004;58(8):1483-1499.

38. Babor T, Higgins-Biddle J, Saunders J, Monteiro M. AUDIT: The Alcohol Use Disorders Identification Test Guidelines for Use in Primary Care: World Health Organization. *Geneva, Switzerland.* 2001.

39. The Royal Australian College of General Practitioners. Guidelines for preventive activities in general practice 8th edition, Appendix C: Audit-C. Available at: http://www.racgp.org.au/your-practice/guidelines/redbook/appendices/appendix-3-audit-c/.

40. "Guidelines for the data processing and analysis of the International Physical Activity Questionnaire", Revised November, 2005, downloaded from http://www.ipaq.ki.se. 2005.

41. Craig CL, Marshall AL, Sjostrom M, et al. International physical activity questionnaire: 12-country reliability and validity. *Med. Sci. Sports Exerc.* Aug 2003;35(8):1381-1395.

42. Hagstromer M, Oja P, Sjostrom M. The International Physical Activity Questionnaire (IPAQ): a study of concurrent and construct validity. *Public Health Nutr.* Sep 2006;9(6):755-762.

43. Hofler M, Pfister H, Lieb R, Wittchen HU. The use of weights to account for non-response and drop-out. *Soc. Psychiatry Psychiatr. Epidemiol.* Apr 2005;40(4):291-299.

44. Fryback DG, Dunham NC, Palta M, et al. US norms for six generic health-related quality-of-life indexes from the National Health Measurement study. *Med. Care.*

Dec 2007;45(12):1162-1170.

45. Li CY, Sung FC. A review of the healthy worker effect in occupational epidemiology. *Occup Med (Lond).* May 1999;49(4):225-229.
46. Naimi AI, Richardson DB, Cole SR. Causal inference in occupational epidemiology: accounting for the healthy worker effect by using structural nested models. *Am. J. Epidemiol.* Dec 15 2013;178(12):1681-1686.
47. Richardson J, Iezzi A, Khan MA, Maxwell A. Cross-national comparison of twelve quality of life instruments. MIC Paper 2. Melbourne: Centre for Health Economics, Monash University. 2012.
48. Cook EL, Harman JS. A comparison of health-related quality of life for individuals with mental health disorders and common chronic medical conditions. *Public Health Rep.* Jan-Feb 2008;123(1):45-51.
49. Pietersma S, de Vries M, van den Akker-van Marle ME. Domains of quality of life: results of a three-stage Delphi consensus procedure among patients, family of patients, clinicians, scientists and the general public. *Qual. Life Res.* Jun 2014;23(5):1543-1556.
50. de Jonge J, Bosma H, Peter R, Siegrist J. Job strain, effort-reward imbalance and employee well-being: a large-scale cross-sectional study. *Soc. Sci. Med.* 2000;50(9):1317-1327.
51. Buddeberg-Fischer B, Klaghofer R, Stamm M, Siegrist J, Buddeberg C. Work stress and reduced health in young physicians: prospective evidence from Swiss residents. *Int. Arch. Occup. Environ. Health.* Oct 2008;82(1):31-38.
52. Rusli BN, Edimansyah BA, Naing L. Working conditions, self-perceived stress, anxiety, depression and quality of life: a structural equation modelling approach. *BMC public health.* 2008;8:48.
53. McCrone P, Patel A, Knapp M, et al. A comparison of SF-6D and EQ-5D utility scores in a study of patients with schizophrenia. *Journal of mental health policy and economics.* 2009;12(1):27-31.
54. Menn P, Weber N, Holle R. Research Health-related quality of life in patients with severe COPD hospitalized for exacerbations-comparing EQ-5D, SF-12 and SGRQ. *Health and Quality of Life Outcomes.* 2010;8(39):1-9.

Appendix 4A Publication of "Construct validity of SF-6D health state utility values in an employed population"

Baxter S, Sanderson K, Venn AJ, Otahal P, Palmer AJ. "Construct validity of SF-6D health state utility values in an employed population" *Quality of Life Research* July 2015; 24(4): 851-870

http://link.springer.com/article/10.1007/s11136-014-0823-4#

"The final publication is available at link.springer.com"

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5 Chapter five: Evaluating the health and economic impact of a workplace health promotion program in the public sector state service: results from the Healthy@Work Project

5.1 Preface

Conducting the economic evaluation of Healthy@Work (H@W) represents a pivotal task in this thesis as well as for the *partnering*H@W partners, who wish to know whether H@W provided value for money. The following analysis takes into account lessons from the previous Chapters and provides a worked example addressing my thesis aim: **to investigate the application of health economics to evaluate workplace health promotion**.

Thus, the investigation within Chapter 5 follows health economic methodological guidelines,[1] and includes health utility alongside productivity outcomes to ensure health is identified, measured and valued in the economic evaluation. Furthermore, it takes into consideration the organisational approach of the H@W project and the value placed by H@W decision makers on improving organisational capacity for health promotion within the Tasmanian State Service. In so doing, this investigation aims to be at the evaluative forefront in WHP and the current literary vision: an evaluation that reflects the ecological nature of WHP by incorporating both individual-level and organisational measures simultaneously.[2]

5.2 Introduction

There is little debate that workplace health promotion (WHP) has value, as it is increasingly recognised in health policies around the world as a strategy for disease prevention.[3-9] Of greater contention is whether it provides value for money; whether the social, health and economic benefits arising from workplace health promotion exceed, equal, or are worth the costs. The state of the evidence that is available to inform such decisions has suffered from health economic methodological inconsistencies and measurement limitations.[10,11] Refer to the Chapter 2 systematic review.

In order to improve the evidence, it is important for economic evaluations to identify, measure and value outcomes that reflect the complexities and comprehensiveness of workplace health interventions. Defined as "the combined efforts of employers, employees and society to improve the health and well-being of people at work," p 2 [12] WHP intrinsically involves individual, social, cultural and political processes, as well as actions that "help build the capacity of individuals, communities, organizations and governments" p12. [13] Incorporating an organisational approach to WHP epitomises the growing interest in this broader multi-layered focus.[14] Indeed, in 2006 'capacity building' was added to the WHO health promotion glossary,[15] emphasising effective health promotion involved advancing knowledge and skills, expanding support and infrastructure and developing cohesiveness and partnerships. Building capacity means improving organisational capabilities; commitment, structures, systems, and leadership.[15] Currently WHP best practice encourages building organisational capacity for health promotion in workforces.[5,16-28] However, no single set of characteristics or scientific evidence validating measurement of organisational supports exist. Despite this, interventions implementing an organisational approach are emergent and proposed "value" in WHP may originate from participatory, multidisciplinary or integrative initiatives. Consequently, economic evaluations should consider incorporating organisational capacity as a measure of efficiencies in resource use to better reflect WHP comprehensiveness.

Decisions as to whose values to consider, what impacts to analyse and what form of economic analysis to use are central to economic enquiry.[29] In WHP undertaking a cost-benefit analysis and reporting a return on investment (ROI) has been the predominant form.[10] However the ROI metric has come under recent scrutiny as the sole measure of value.[16] Cited inadequacies include its implied certainty and the presumption that a program has failed if it doesn't produce a positive ROI. Fundamentally, 'value' must be defined by the decision maker whose resources are given up and value for money conditional on a value threshold that may reflect budget constraints, best alternative use of funding or other decision maker considerations such as their specific goals and guidelines.[30]

An intervention would be considered cost-effective when it costs less than the chosen threshold value.[30,31] Cost-effectiveness analysis (CEA) has long been considered the gold standard decision analytic tool for health technology assessment.[30-34] It offers technical advantage when evaluating uncertainty and does not require outcomes to be monetized, rather pertains to the decision rule that an intervention is worthwhile if its cost-effectiveness ratio is less than the maximum willingness to pay (the threshold value). Additionally, the recently developed Value on Investment (VOI) framework for employee health management incorporates CEA conventions.[16] The overarching goal for evaluators is to offer a more complete picture of economic value; one that is transparent and one that captures unbiased evidence of importance to inform employer or policy maker decisions.

We present a health economic evaluation of a four year WHP project guided by these principles and cognisant of the challenges. The project, Healthy@Work (H@W), was implemented to the public sector state service population of Tasmania, Australia. It was coordinated and policy driven by the Tasmanian State Service (TSS) Management Office (employer and decision maker). An Art of Hosting Action Conversation,[35,36] a diverse discussion to develop and synthesise ideas, was convened between employer and evaluators in 2011 to inform the 'value for money' proposition which outlined the outcomes of value to the employer. These included measures of organisational change, worker impacts (productivity and employee health and wellbeing) and community reach, with an overarching H@W goal to instil health-promoting culture. To provide the decision maker with evidence to assess if their investment was good value for money our stated research question was: "What were the costs and benefits of the Healthy@Work Project (H@W) (2008-2012) on Tasmanian State Service employee productivity, health status, and healthcare utilisation for agencies of high organisational capacity (a strong capability to improve the health and wellbeing of their employees), compared to agencies with 'low' organisational capability, from the State Service Management Office (employer's) perspective?"

5.3 Methods

The current standard for writing up an economic evaluation has been followed by using the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement. [1] CHEERS has been adopted in order to guide evaluation content, assist evidence reporting and improve transparency.

5.4 Design

This prospective health economic evaluation was conducted alongside an observational study of Healthy@Work (H@W). H@W was rolled out simultaneously across the entire organisation with no staging or control group and represented a real world application of workplace health promotion. The H@W vision was: Well developed and effective workplace health and wellbeing programs integrated within each Tasmanian Government agency. H@W was based on a consistent model (Figure 5.1) with the purpose for Government 'to increase the efficiency and productivity throughout the Tasmanian State Service through a State Service culture that values, supports and improves the health and wellbeing of employees.' Given the observational design and multiple measures of importance for the decision maker, a cost consequence analysis was presented, listing all costs and benefits that arose. Additionally, a cost-benefit and cost-effectiveness comparative analysis of costs and benefits between agencies of high versus low organisational capacity was performed to provide evidence on value for money in building organisational capacity for health promotion across all agencies, an outcome valued by the decision makers. Incremental net monetary benefit statistic was used to ascertain measure of uncertainty. The study was approved by the Tasmanian Health & Medical Human Research Ethics Committee: H0010501.

5.4.1 Study perspective

Costs of implementing H@W were derived from an employer perspective, represented by an Australian state government organisation. Costs included direct non-medical costs; program costs (resource development and implementation, infrastructure, operational expenditures, and staffing costs including salary, travel, supplies, and internal training); and cost-offsets (benefits) related to indirect/productivity loss costs (employee absenteeism and presenteeism), direct medical costs covered by the state government (employee hospital utilisation: admissions and overnight stays), and employee health utility. The state government as employer was a unique perspective that allowed for direct medical costs covered by the state government (not routinely borne by an Australian employer) to be incorporated.

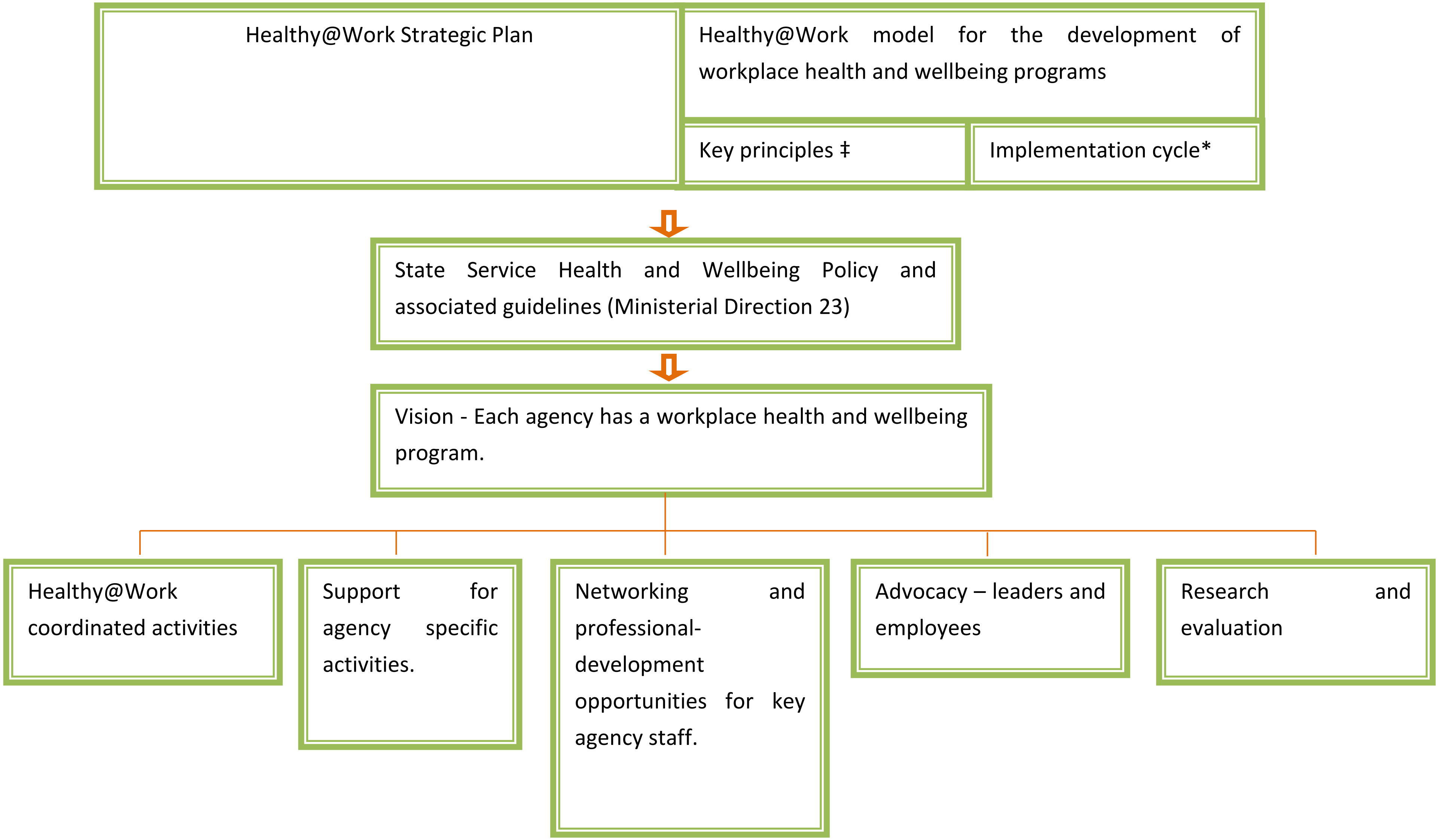

Figure 5.1 Healthy@Work Structure[θ]

The model developed and adopted by the central coordinator to consistently support the Healthy@Work project across all Agencies within the Tasmanian State Service. It allowed Agency-flexibility to develop programs specific to the employee needs of their organisation.

ϴ Reproduced with permission from the Healthy@Work Strategic Plan[37]

‡Evidence based[38-43] and used in policy guidelines (Ministerial Direction 23). For a list of the key principles see Table 5.1

*** Evidence-based[38,42] and used as the foundation for development of Agency health and wellbeing programs. Implementation cycle included: Program initiation, Establishment of a coordination mechanism, Conduct a needs assessment, Develop an action plan, Implement the action plan, Monitor and evaluate, Revise and update the program.**

5.5 Sample

The target population for H@W was all TSS employees representing between 28,000 and 30,000 individuals working in any one year. They were located within fourteen agencies throughout the island state (68,401 square kilometres[44]), and delivered public service to the state's 510,600 inhabitants.[45] The employees were diverse and included senior executives, front line workers, clerical workers, administrators, lawyers, teachers, police, health and emergency personnel, technicians, service providers, labourers, junior graduates and cadets. A list of the agency names can be found in acknowledgements. Data were captured from a repeated cross-sectional *partnering*H@W (*p*H@W) survey of TSS employees selected by stratified random sampling (with oversampling for estimation in agencies with few employees).

5.5.1 Comparators

No comparators were required for the cost-consequence analysis and no intervention or comparator groups were originally assigned due to the ecological nature of the study design. However, in the attempt to provide evidence of greatest utility for the decision maker who valued building health promoting capacity within the TSS, an organisational capacity measure ('capacity') was developed that allowed for comparisons. At the conclusion of the study period employees were categorised according to their agency's level of capacity; high, middle or low. Employees within agencies that received the intervention at the highest capacity level (the intervention group) were classified as being in a high capacity agency, while employees working in low capacity agencies were classified as having received the intervention at the lowest capacity level (the comparator group). Details on the capacity measure are provided below under 'measurement of effectiveness.'

5.6 Measures

Employee health status, lost productivity, and healthcare utilisation were available for the economic evaluation. The *p*H@W survey was developed in collaboration with the decision maker and included validated or well-tested common measures.

Lost productivity from absenteeism (days absent due to health problems) and presenteeism (days at work while suffering from health problems multiplied by 1-[reported fraction of normal productive capacity when working while ill]) was measured using a 4 week recall and annualised (number of days per year) by linear extrapolation, an accepted convention.[46,47] Days due to absenteeism and presenteeism were combined to measure Total Lost Productive Time. An elasticity factor of 0.8 was applied to absentee days assuming 100% lost labour is proportional to 80% reduced productivity.[48] Productivity loss was valued using individual annual salary rates in days i.e. annual salary divided by 240 working days per year for full time (5 days x 4 weeks x 12 months), and 120 days for part-time/casual employees. Salary figures were sourced from a centralised TSS administrative database.

Health care utilisation was measured by the number of hospital admissions and number of nights admitted in total over the last 12 months. Other less extreme health events such as GP (primary care) visits or pharmaceutical use were not asked within the *p*H@W survey due to costing difficulties. Hospital admissions were valued from the Tasmanian Major Hospital average cost per day for Australian Revised Diagnosis Related Group (AR-DRG). All units and costing are presented as average per employee per year.

5.6.1 Choice of health outcomes

Health outcomes were measured by preference-based health status (SF-6D health utility). Health utility is an internationally recognised gold standard measure of health outcome in cost-effectiveness analysis[30-32] and cost-effectiveness analysis has been recently recommended in workplace health promotion in order to inform the value on investment.[16]

5.6.2 Measurement of effectiveness

Effectiveness was measured by organisational capacity. Capacity was identified by the degree an organisation (agency) developed, implemented and sustained a workplace health and wellbeing program. It was linked to the H@W vision. The vision was communicated broadly throughout the intervention years and supported by policy; 'Ministerial Direction 23 (MD23): Workplace Health and Wellbeing.' The policy was accompanied by a set of guidelines.[49] These documents were evidence-based[38,41] and outlined key principles for implementing H@W. Both the MD23 and its guidelines were signed by the Tasmanian Premier (head of government) on June 7, 2010, providing administration powers under the *State Service Act 2000*. Updated versions of the policy were signed by the Premier on August 21, 2012 and February 4, 2013.[50]

Valuation of 'capacity' was linked to agency compliance to the MD23 key principles which were embedded within an agency Health and Wellbeing Audit. Audits were completed by agency-specific managers or workplace health coordinators for all agencies in 2010, 2011, and 2012. Capacity-related audit questions sought respondents' level of agreement with twenty 'MD23 key principle' statements (see Table 5.1), and further included eleven open ended questions to enrich these data.

Table 5.1 Key principles captured within the Agency audit survey* used to assess organisational capacity

How strongly do you agree with the following statements in relation to the agency health and wellbeing program? Our Program ….

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	Not applicable
Is cost effective	☐	☐	☐	☐	☐	☐
Acknowledges and supports Occupational Health and Safety practices	☐	☐	☐	☐	☐	☐
Is managed within the organisation	☐	☐	☐	☐	☐	☐
Includes an assessment of the needs within the organisation	☐	☐	☐	☐	☐	☐
Involves voluntary participation by employees	☐	☐	☐	☐	☐	☐
Involves high levels of participation by staff	☐	☐	☐	☐	☐	☐
Program coordinators have access to relevant professional development opportunities	☐	☐	☐	☐	☐	☐
Coordinators have access to appropriate information and resources to support the development of the program	☐	☐	☐	☐	☐	☐
Is sustainable because it is integrated within the organisations ongoing operations	☐	☐	☐	☐	☐	☐
Is supported by a long-term commitment by the agency	☐	☐	☐	☐	☐	☐
Involves access to the program for all staff irrespective of the current health status or role within the organisation	☐	☐	☐	☐	☐	☐
Involves an evaluation process	☐	☐	☐	☐	☐	☐
Involves strategies that address a range of individual, organisation and environmental issues	☐	☐	☐	☐	☐	☐
Is strongly supported by senior	☐	☐	☐	☐	☐	☐

management						
Senior management participate in program activities	☐	☐	☐	☐	☐	☐
Is promoted well internally to staff.	☐	☐	☐	☐	☐	☐
Is promoted well to people outside of the organisation	☐	☐	☐	☐	☐	☐
Staff are supported by their supervisors to take part	☐	☐	☐	☐	☐	☐
The program is regularly reviewed and updated	☐	☐	☐	☐	☐	☐
Staff are consulted in relation to program content	☐	☐	☐	☐	☐	☐

***Key principles were developed by the H@W central coordinator from evidence,[38-43] and documented in the policy guidelines[49] and the Healthy@Work model (Figure 5.1). Reproduced with permission.**

An extensive effort to capture agency capacity was undertaken using an integrative mixed methods approach (a matrix).[51,52] The matrix incorporated; (i) the quantitative and qualitative audit data, (ii) additional data from face-to-face semi-structured interviews with agency key personnel (collected for a *p*H@W process evaluation), and (iii) a measure of program exposure identified through individual employee responses to questions within the *p*H@W survey and assessed using a checklist of 5 key elements in program comprehensiveness.[53] Each agency received a score or comment against each feature within the matrix to indicate level of achievement. The matrix therefore facilitated integration of all available data for each agency. Two of the authors (SB and KJ) independently considered the matrix data to rank then categorise agencies into high, middle or low capacity levels. On two occasions and in order to meet consensus, two agency health and wellbeing plans (a completion requirement for all agencies at the inception of the MD23) were additionally examined.

For the purposes of analysis high capacity agencies demonstrated greatest adherence to the MD23 key principles and employees within these agencies were considered to have received an 'optimal' intervention. Thus, in line with the H@W vision and in accordance with TSS policy these agencies most strengthened their capability to improve the health and wellbeing of their employees. In contrast, 'low'-ranked agencies underperformed against these benchmark guidelines and their employees received an under-delivered program. The capacity measure was tested for internal consistency using additional employee responses from the *p*H@W survey (refer to 5.9 Results).

Refer to the *p*H@W 2013 survey Chapter 1 Appendix 1D, Section E Questions: 27, 28, 29, 30, 31 and 35 for the questions used to test internal consistency. Reproduced in Appendix 5A

This integrative valuation of capacity, that required ranking as a means to place value on an outcome, was considered more appropriate than an economic measure of capacity (i.e. measuring capacity by productivity efficiencies), as it reflected the inherent policy intention of H@W to establish a health-promoting culture. Moreover, difficulties in measuring productivity efficiencies in this public sector have been documented.[54]

5.6.3 Measurement and valuation of preference based outcomes

Overall health was assessed using the health-related quality of life (short form SF-12v2[55]) questionnaire, and health utilities (SF-6D) were derived from this as the measure of health outcome amenable to economic evaluation. Health utility measures the strength of preference for a particular health state. Values are anchored between 0 and 1, where 1 represents the equivalent of being alive for a certain proportion of a year in perfect health. SF-6D values were derived from Brazier's algorithm[56] using standard gamble from United Kingdom general population norms. Employee responses to the SF-12v2 questionnaire were converted by algorithm into employee SF-6D health utility at 2010 and 2013. Although there is currently no published SF-6D (SF-12) algorithm from Australian general population norms, the construct validity of SF-6D using Brazier's algorithm in Australian employed populations has been demonstrated.[57]

5.7 Intervention

5.7.1 Setting

The Tasmanian State Service (TSS) has advocated and supported public health initiatives for health and wellbeing of Tasmanian workers since 2001.[39] Implementation of H@W is one way the TSS is responding to increasing uncertainty, including fiscal constraints, demographic change and an aging population. The employees of the TSS are pivotal to the success of the state for their provision of Government services, policies and programs to the whole community. However, they are aging and the future composition of the TSS is facing great challenge. "In the next five to ten years, more than 50 per cent of the State Service workforce will be at the minimum retirement age. In excess of 15,000 people may exit the workforce" p4. [58] In 2008 the TSS announced a four-year commitment of resources to support its own agencies. The allocated budget was $2,014,037 AUD.

5.7.2 Healthy@Work Project (2008-2012)

Central coordination included developing and resourcing interventions across all agencies with a coordinated education and communication strategy, mental health and wellbeing training, consultancy service, a project website, grants and subsidies. Each agency (n=14) within the TSS was required to develop a workplace health program plan for preventive strategies. Identification of employee needs and preferences was conducted by the TSS in 2009 using an online employee assessment tool, including automated personalised health-promotion feedback for employees and agency summary data for managers. This identified any number of key health risk factors for appropriate program targeting. Programs included activities and health-promoting interventions for smoking, nutrition, physical activity, sedentary behaviour, alcohol consumption and psycho-social health. Examples included stress management, pedometer challenges, influenza vaccination, breaking-up sedentary time, healthy catering (cafeteria or vending machines), Employee Assistance Programs (EAP), smoke free policies and other activities encouraging an organisational change approach to improve culture, policies and resources in relation to health and wellbeing. A more detailed explanation of H@W including the study design has previously been published.[59-61]

Number, type and duration of activities were agency-specific. Potentially, all employees in their working surrounds received varying levels of visible or active health promotion resource. Employee risk factor snapshots by agency were provided in 2011 and 2013 by researchers working in partnership with the central coordinators, and agencies had the opportunity to tailor or sustain programs in response.

5.8 Analysis

5.8.1 Forms of economic analysis

The array of benefits was quantified separately alongside costs in a cost-consequence analysis. Additionally and by utilising the organisational capacity measure, we investigated cost-effectiveness of employee health utility and performed a cost-benefit analysis on reduced medical costs and lost productive time between high versus low capacity agencies.

5.8.2 Estimating resource use and costs

Data on resource use (program costs) were compiled by the central coordinator for operational costs (resource development, implementation, agency grant funding, infrastructure and incidentals) and salary and staffing costs associated with the coordination. Resources were allocated in 2008/2009 financial year and budgeted annually across the four intervention years. Costs and benefits were evaluated over the entire four year time horizon. Benefits were estimated alongside costs in 2010 and 2013 by the *p*H@W survey.

5.8.3 Currency, price date, and conversion

Both costs and cost offsets were reported as price year 2009 Australian Dollars using Consumer Price Indexing.[62] No discounting was performed due to the short time horizon of the study.[63] However, sensitivity analysis incorporating a 5% discount rate [32] was performed for benefits relating to productivity loss as it has been shown that these can occur within two – five years. [74]

5.8.4 Analytical methods

All analyses were reported on a "per employee" basis. Self-reported data from the 2010 and 2013 *p*H@W survey were propensity weighted for non-response to present TSS population-level summary statistics as means and standard errors. The propensity weighting model has been previously described.[57] All statistical analyses for cost-consequence and cost-benefit tables were conducted using STATA© version 12 software package (Statacorp LP, Texas, USA).

For the cost-effectiveness analysis the incremental net monetary benefit (INMB) statistic by way a confidence ellipse was used for analysis of uncertainty.[64,65] The application of the INMB framework is encouraged when analysing occupational interventions when person-level data is collected alongside the economic evaluation.[66] Use of the INMB also mitigates the need to assign an arbitrary threshold value for an effectiveness measure of health, a standard practice in health technology assessment but one that has raised concern by occupational health leaders.[67]

5.9 Results:

At the conclusion of H@W after 4 years all agencies had programs in place and each agency had implemented, on average, 21 individual health and wellbeing activities.[68] Ninety per cent of employees had access to activities and more than 75% accessed at least one of them.[61] On average, the project website received 600 visits per month.

Characteristics of the survey study populations stratified by year and organisational capacity are presented in Table 5.2. The weighted results by year represent the entire TSS employee sampling frame of 27,659 and 27,439 in 2010 and 2013 respectively. Weighting for non-response accounted for the low response rate of sampled employees (28% of 12,179 (n=3,410) respondents in 2010 and 27% of 12,007 (n=3221) respondents in 2013). The TSS population mean age (standard error) was 44.9 (0.2 years) in 2010 and 45.5 (0.2) in 2013 and annual salary was $66,233 (489) and $72,541(430) respectively. Both age and salary increased expectedly with the longitudinal nature of data collection. In the TSS across both years there was a majority of female (66%, 68%), married (63%, 64%), full time (61%, 56%) and permanently employed (90%, 88%) workers.

Internal consistency of the organisational capacity measure using questions from the *p*H@W survey showed employees from high capacity agencies reported greater agreement with positive statements on culture, personal attachment and attitudes relating to both the H@W intervention and the TSS in comparison to employees of low capacity agencies (positive correlation $p<0.01$, see Appendix 5A).

Table 5.2 Characteristics of the whole of Tasmanian State Service (TSS) employee population, stratified by organisational capacity*

	TSS				Agency Organisational Capacity (2013)					
	2010		2013		High[a]		Middle[b]		Low[c]	
	n	mean(se)	n	mean(se)	n	mean(se)	n	mean(se)	n	mean(se)
Age (years)	3408	44.9(0.2)	3221	45.5(0.2)	603	42.5(0.4)	1339	47.3(0.3)	1279	44.7(0.3)
Annual salary ($)	3408	66,233(489)	3221	72,541(430)	603	74,035(898)	1339	72,591(535)	1279	71,914(824)
Health utility β	3356	0.778(0.0)	3173	0.783(0.0)	598	0.787(0.01)	1328	0.782(0.00)	1247	0.782(0.00)
	n	%(se)	n	%(se)	n	%(se)	n	%(se)	n	%(se)
Proportional										
Females	2444	66(0.01)	2307	68(0.01)	338	50(0.02)	981	70(0.01)	988	74(0.01)
Married	2123	63(0.01)	2066	64(0.01)	383	63(0.02)	901	68(0.01)	782	61(0.01)
University	1803	54(0.01)	1748	55(0.01)	306	49(0.02)	769	57(0.01)	673	55(0.01)
Occupational type‡										
blue collar	582	18(0.01)	534	18(0.01)	-	-	80	6(0.01)	453	37(0.01)
service	1304	40(0.01)	1308	44(0.01)	110	24(0.02)	555	44(0.01)	643	52(0.01)
manager	399	12(0.01)	314	9(0.00)	101	14(0.01)	116	8(0.01)	97	8(0.01)
Full time employed [ϕ]	2057	61(0.01)	1871	56(0.01)	449	75(0.02)	758	55(0.01)	664	51(0.01)
Permanent employment [λ]	3104	90(0.01)	2819	88(0.01)	517	87(0.01)	1179	88(0.01)	1123	88(0.01)
$60,000-80K per annum[ψ]	1502	43(0.01)	926	29(0.01)	209	37(0.02)	249	19(0.01)	468	37(0.01)

‡ refers to Australian and New Zealand Standard Classification of Occupations (ANZSCO);[69] blue collar, white collar, service, professional, manager

***Propensity weighted for non-response (sampling frame N=27,659 in 2010 and 27,439 in 2013)**

Ψ Refers to annual salary in 2009 Australian Dollars. 36% (0.02) had increased their annual wage over the 4 year project this range.

[a] Five agencies out of the total 14 agencies across the TSS were classified 'high' in organisational capacity, propensity weighted results representing 4,128 State Service employees

[b] Five agencies out of the total 14 agencies across the TSS were classified 'middling' in organisational capacity, propensity weighted results representing 11,348 State Service employees

[c] Four agencies out of the total 14 agencies across the TSS were classified 'low' in organisational capacity, propensity weighted results representing 11,683 State Service employees

[Φ] Employees were categorised either full time or part-time/casual as employment condition

β Measured using SF-6D derived from SF-12v2 health-related quality of life survey[56]

[λ] Employees were categorised either permanent or non-permanent/fixed as employment category

In 2013, upon completion of H@W, 4,128 employees were working within agencies of high organisational capacity (n=5) versus 11,683 employees in low capacity agencies (n=4). Employees working in high capacity agencies were more likely to be younger 42.5 (0.4) vs 44.7 (0.3) years, male (50% vs 28%), working full time (75% vs 51%), with a higher proportion of managers (14% vs 8%) and a higher mean annual salary $74,037 (898) vs $71,914 (824).

The cost-consequence analysis, mean overall costs from budget records and benefits over the four years for H@W expenditure, are presented in Table 5.3. A further breakdown of these costs and benefits by agency organisational capacity is presented in Table 5.4.

Costs of the program: The H@W project required 2.5 full time equivalent positions. On top of staffing costs, the H@W model aimed to fund central coordination, individual agency-specific programs and resource development. As a result, overall H@W costs were combined under four levels of operational expenditures, and salary and staffing costs. Unit costs were not presented as these were exhaustive, however examples of funding outlays within expenditure categories are provided. The budgeted cost of H@W was $2,044,324; $74 per employee over 4 years, $18 per employee per year.

Consequences (benefits): There was no difference in estimated total lost productive time between years 2010 and 2013. Thus TSS employees (N=27,159) recorded mean (SE) 9.9 (0.3) days per annum (7.8 days absent, 3.7 days due to presenteeism) [overall 8.5 (0.5) days per annum 7.0 days absent, 3.1 days presenteeism with 5% discount] at an average cost (SE) of $3,968 (206) per employee per year [$3,402 (177) discounted]. Overall healthcare utilisation was low with mean number of hospital admissions 0.1 (0.00) and overnight stays 0.4 (0.03) across the project years [with no change upon discounting]. Totalled mean cost offsets for lost productive time and hospital utilisation were $4,002 (199) per employee per year for the H@W implementation period [$3,431 (171) at 5% discount rate].

Overall health utility (SE) was 0.780 (0.0); no significant change was seen between 2010 (0.778 (0.0)) and 2013 (0.783 (0.0)). For this reason and due to the uncertainty of effect over time, QALYs were not estimated.

Table 5.3 Cost Consequence Analysis; costs and associated costs of productivity loss and hospital utilisation for the Tasmanian State Service (TSS) Healthy@Work (H@W) project, overall

						TSS Overall	
H@W project cost	Source					Mean cost	Total Cost
Salary and associated staffing costs*	Budget					47,084(0)	659,178
Centralised implementation ψ	Budget					197,780(1,775)	676,091
Individual agency grants λ	Budget					8,453(228)	244,513
Organisation/Community resource development φ	Budget					109,732(960)	387,272
Infrastructure and incidentals	Budget					21,894(192)	77,270
Total H@W cost							**2044324**
Cost per employee[Φ]							**74(1)**
Cost per employee per year							**18(0)**
				2010	2013	TSS Overall	
H@W cost offsets (per year)	Unit Cost	Source‡	Unit of measurement	Mean units	Mean units	Mean units	Mean cost
Health utility	-	-	-	0.778(0.0)	0.783(0.0)	0.780(0.0)	-
Absenteeism	Indiv	a	Days	7.5(0.5)	8.2(0.5)	7.8(0.3)	3,307(214)
Presenteeism	Indiv	a	Days	3.9(0.2)	3.6(0.2)	3.7(0.2)	-
Total lost productive time θ	**Indiv**	**a**	**Days**	9.9(0.5)	9.9(0.5)	9.9(0.3)	3,968(206)
Hospital admission ≈	846	b	Admits	0.1(0.0)	0.1(0.0)	0.1(0.0)	84(5)
Hospital overnight stay	1282	b	Stays	0.4(0.0)	0.5(0.1)	0.4(0.0)	119(7)
Total hospital cost	-	-	-	-	-	-	405(23)
Overall total cost offsets β	-	-	-	-	-	-	**4,002(199)**

NB: All costs reported in 2009 Australian Dollars (AUD)

***Example of associated staffing costs include: office supplies, travel, internal training, and superannuation. Costs were divided evenly among the 14 agencies as each agency regardless of size received the same level of project coordination**

λ Examples of costs include: funding for facility improvements, mental health and wellbeing training, coaching programs for managers, sedentary break-time software, health assessments and activities focussed on nutrition, alcohol consumption, education, and stress management.

ψ Example of costs include: corporate physical activity challenges, centralised mental health and wellbeing training and subsidies. Centralised funds were divided evenly and proportionally to number of employees using average agency head count in order to ensure employees working within the largest of agencies had equity

φ Example of costs include: development and delivery of workplace coordinator professional development program, smoke-free workplace and healthy workplace resource toolkits, healthy options for vending (HOVER) project, public health initiatives for physical activity and health promotion conference

[Φ]average over the 4-year program implementation

Indiv refers to Individual. Unit costs sourced from an individual employee's annualised salary

‡ Sources of unit costs used in the analysis (a) individual employee salary from a centralised Tasmanian State Service administrative database, extracted in 2010 and 2013, updated for inflation, (b) 2012-13 TAS Major Hospital average cost per day for Medical AR-DRG (Diagnosis Related Group) corrected to 2009 AUD, average costs of admission equates two thirds cost of overnight stay.

θ Days due to absenteeism and presenteeism were combined to measure Total Lost Productive Time. An elasticity of 0.8 was applied to absent days indicating 1 day absent was equivalent to 80% lost productive time.

≈ Unit cost when admitted into hospital was $846 and any subsequent overnight(s) stay within the admission incurred an additional $1282, valued from the Tasmanian Major Hospital average cost per day for Australian Revised Diagnosis Related Group (AR-DRG).

β Costs of total lost productive time and total hospital costs

Table 5.4 Cost consequence analysis by organisational capacity

		Agency Organisational Capacity			
		High N=4,128	Middle N=11,348	Low N=11,683	Difference (H-L)
H@W project cost	Source	Mean cost	Mean cost	Mean cost	Incremental cost
Salary and associated staffing costs*	Budget	47,084(0)	47,084(0)	47,084(0)	0
Centralised implementation ψ	Budget	30,402(502)	198,197(2,389)	261,513(1,190)	-231,111(1,291)
Individual agency grants λ	Budget	29,486(365)	6,375(331)	2,678(47)	26,808(368)
Organisation/Community resource development φ	Budget	17,179(284)	111,486(1,274)	143,294(649)	-126,115(709)
Infrastructure and incidentals	Budget	3,428(57)	22,244(254)	28,591(130)	-25,163(141)
Total H@W cost		**527,027**	**802,682**	**714,615**	**-187,588**
Cost per employee[Φ]		**129(2)**	**69(2)**	**58(1)**	**70(3)**
Cost per employee per year		**32(1)**	**17(0)**	**15(0)**	**18(1)**

				High		Middle		Low		Difference (H-L)	
H@W cost offsets (per year)	Unit Cost	Source‡	Unit	Mean units	Mean cost	Mean units	Mean cost	Mean units	Mean cost	Mean units	Mean cost
Health utility				0.787(0.0)	-	0.782(0.0)	-	0.782(0.0)	-	0.006(0.0)	-
Absenteeism	Indiv	a	Days	6.3(0.8)	2,451(319)	7.8(0.8)	3,150(337)	9.4(0.8)	3,804(362)	-3.1(1.2)	-1,353(482)
Presenteeism	Indiv	a	Days	3.9(0.5)	-	3.2(0.3)	-	3.8(0.5)	-	0.1(0.7)	0
Total lost productive time θ	**Indiv**	**a**	**Days**	**8.4(0.8)**	**3,270(353)**	**9.3(0.7)**	**3,715(301)**	**11.2(0.9)**	**4,511(365)**	-2.8(1.2)	**-1,240(507)**
Hospital admission ≈	846	b	Admits	0.1(0.0)	73(10)	0.2(0.0)	96(8)	0.1(0.0)	74(7)	0.01(0.0)	**-1(12)**
Hospital overnight stay	1282	b	Stays	0.4(0.1)	104(15)	0.5(0.1)	133(11)	0.4(0.1)	108(10)	0.02(0.1)	**-4(18)**
Total hospital cost	-	-	-	-	355(48)	-	458(37)	-	365(34)	-	**-10(59)**
Overall total cost offsets β	-	-	-	-	**3,358(346)**	**-**	**3,751(289)**	**-**	**4,526(355)**	**-**	**-1,168(495)**

NB: All costs reported in 2009 Australian Dollars (AUD)

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*Example of associated staffing costs include: office supplies, travel, internal training, and superannuation. Costs were divided evenly among the 14 agencies as each agency regardless of size received the same level of project coordination

λ Examples of costs include: funding for facility improvements, mental health and wellbeing training, coaching programs for managers, sedentary break-time software, health assessments and activities focussed on nutrition, alcohol consumption, education, and stress management.

ψ Example of costs include: corporate physical activity challenges, centralised mental health and wellbeing training and subsidies. Centralised funds were divided evenly and proportionally to number of employees using average agency head count in order to ensure employees working within the largest of agencies had equity

φ Example of costs include: development and delivery of workplace coordinator professional development program, smoke-free workplace and healthy workplace resource toolkits, healthy options for vending (HOVER) project, public health initiatives for physical activity and health promotion conference

$^{\Phi}$average over the 4-year program implementation

Indiv refers to Individual. Unit costs sourced from an individual employee's annualised salary

‡ Sources of unit costs used in the analysis (a) individual employee salary from a centralised Tasmanian State Service administrative database, extracted in 2010 and 2013, updated for inflation, (b) 2012-13 TAS Major Hospital average cost per day for Medical AR-DRG (Diagnosis Related Group) corrected to 2009 AUD, average costs of admission equates two thirds cost of overnight stay.

θ Days due to absenteeism and presenteeism were combined to measure Total Lost Productive Time. An elasticity of 0.8 was applied to absent days indicating 1 day absent was equivalent to 80% lost productive time.

≈ Unit cost when admitted into hospital was $846 and any subsequent overnight(s) stay within the admission incurred an additional $1282, valued from the Tasmanian Major Hospital average cost per day for Australian Revised Diagnosis Related Group (AR-DRG).

β Costs of total lost productive time and total hospital costs

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5.9.1 Incremental cost-effectiveness analysis of high versus low organisational capacity

On the basis of the cost-consequence analysis (Table 5.4), when agencies were stratified by high versus low organisational capacity, the cost of H@W per employee per year was $32 vs $15 respectively, a mean difference (95% CI) of $18 (16-19) ($129 vs $58 mean overall H@W cost per employee). High organisational capacity agencies had less total lost productive time (8.4 (0.8) days) compared to low (11.2 (0.9) days), a mean difference of 2.8 (1.2) days gained productivity per employee per year [7.2 (0.7) vs 9.6 (0.8) days, mean difference 2.4 days at a 5% discount rate], representing a cost saving of $1,240 (507) with a 95% CI (246 to 2,234) per employee per year [$3,270(353) vs $4,511 (365)], that reduced to $1,063 (312) savings at 5% discounting. Combined with healthcare cost offsets, employees (N=4,128) within high organisational capacity agencies were on average saving the TSS $1,168 (495) with 95% CI (197 to 2,139) [$1,001 (304) discounted] per employee per year relative to employees within low organisational capacity agencies.

From these monetized benefits, net benefits (NB = benefits-costs), benefit cost ratios (BCR=benefits/costs) and return on investment (ROI = (benefits-costs)/costs)[19] were calculated. Overall, high capacity agencies spent $129 per employee and saved $1,168 in terms of productivity loss and healthcare utilisation. The cost-benefit estimates were; NB=$1,039, BCR=9.05, and mean (95% CI) ROI=8.05 (0.53 to 15.58), indicating TSS gained $8 ($0.5 to $16) per dollar invested, an increase of 805% on resources spent on high compared to low organisational capacity agencies. Under sensitivity analysis NB=$872, BCR=7.76 and mean (95% CI) ROI=6.76 (-0.68 to 14.20) (5% discount rate).

A cost-effectiveness analysis of H@W to assess value for money in costs and health state utility (SF-6D) values of high versus low organisational capacity agencies was moot as there was no health effect, meaning there was no difference in health utility mean(SE) 0.006 (0.0) for the additional cost ($70). Furthermore we have estimated the minimally important difference of SF-6D in the Australian employed population to be 0.023 (refer to Appendix 5B). This value is within range of other populations (0.010-0.048)[70] and much higher than the 0.006 found in H@W. In light of no health effect the incremental net monetary benefit (INMB) statistic was used only to demonstrate uncertainty using confidence ellipses on a cost-effectiveness plane around the point estimate (0.006, $70). Figure 5.2 highlighted comparatively that high organisational capacity agencies demonstrated negligible increments in employee health utility, that health utility crossed the y-axis into the north west quadrant for all probability distributions, and only at the upper 95% limit reached a minimally important difference.

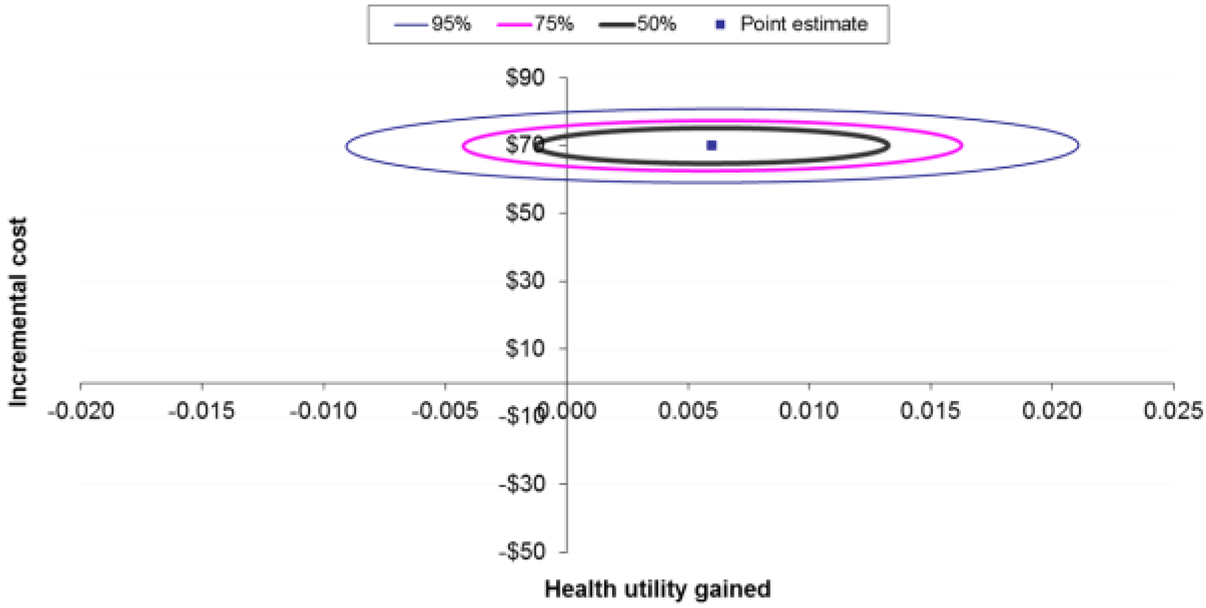

Figure 5.2 Confidence ellipse for employee health status for high vs low organisational capacity

Using the incremental net benefit statistic framework this confidence ellipse represents the distribution of cost and health effect at 50%, 75% and 95% confidence intervals, when difference between high versus low organisational capacity on employee health utility and costs is at the point estimate 0.006, $74.

5.10 Discussion

H@W (2008-2012) supported and developed health and wellbeing programs within each government agency of the Tasmanian state service (TSS). It was rolled out simultaneously across the entire organisation with no staging or comparator arm. The study was observational in design and represented a real world application of workplace health promotion. Our research was performed opportunistically, and started one year into the project.

At the conclusion of the 4 year project the $2.04 million budget was fully expended or committed at a project cost of $74 per employee for the ≈28,000 employees involved. There were no differences in health and productivity measures between the two time points 2010 and 2013.

A cost-consequence analysis provided outcomes of interest for the decision maker alongside costs, a common and accepted method for presenting health economic results. Indeed, a

2009 review of public health interventions found 78% of economic evaluations conducted either a cost-effectiveness or cost-consequence analysis.[71] Furthermore, and in light of measurement challenges, the National Institute for Health and Care Excellence (NICE) in the UK advocates cost-consequence analyses when it is not appropriate to conduct a cost-utility (cost-effectiveness) analysis.[72] For the H@W decision maker, the Tasmanian Government, this form of economic evaluation displays results so it can decide on the relative importance of outcomes, conditional on its threshold value to further invest.

The H@W project focussed on strengthening the capability of the TSS to improve the health and wellbeing of their employees. As such, the decision makers placed value on the processes initiated through H@W towards achieving outcomes and not only on the outcomes themselves. In terms of shifting organisational capacity, we determined the additional cost incurred by high capacity agencies offered some value. However, the ROI ratio denominator (program cost) was considerably small due to the large employee population. The inadequacy of the ROI ratio to account for small denominator costs has previously been published.[73] As a result, the reported H@W return on investment figure is an imperfect judgement on value for money.

Measuring employee health status was also valued by the decision maker. Embedded within the *p*H@W survey was a health-related quality of life measure that derived health utility (SF-6D). A broader explanation on how health utility is derived and its applicability for economic evaluations in workplace health promotion is available within a separate study on this H@W employee population[57] (refer to Chapter 4). It has previously been demonstrated that SF-6D health utility discriminates between employee job stress, psychological stress, comorbidity, body mass index and age within this TSS public sector. We considered conducting a cost-effectiveness analysis of employee health utility using SF-6D however the cost-consequence analysis results that demonstrated no change. Figure 5.2 highlighted the large probability distributions surrounding the SF-6D values therefore in respect to health it indicates no value was achieved. This indicated there was no association between capacity and employee health status. A cost-effectiveness analysis is inappropriate when no effect is achieved.[30,31] Further analysis using the INMB framework was unwarranted.

Changes to health arising from workplace interventions are known to be a long-term benefit[63,74] and no expectation to demonstrate change in health status over the four year H@W implementation period was made. It is reasonable to consider possible undetected value was achieved. An example of an unmeasured consequence in H@W was the wider community reach, accounting for $387,272 (19%) of funding for resource development (Table 5.3). Benefits from use of these resources could be long-lasting and wide-reaching, and affect individuals not only employed at the TSS. This represents a multi-operational level of complexity with increasing evaluative challenge.[75] Moreover it would require broadening the level of analysis to a societal perspective. Evidence of economic methodological techniques to assess multiplier impacts from investments in community health promotion activity is emerging.[76]

There was an expectation that H@W could, by changing TSS culture, assist in ongoing sustained efforts and long-term adherence to behaviour change for improved employee health. The ability to measure sustained outcomes by linking short term evidence with long term benefits[77] is a key priority for economic evaluations in WHP. Modelling past the intervention period was not undertaken here.

5.10.1 Generalisability

The current evaluation has a number of generalisability considerations. H@W was implemented in a large and diverse Australian public sector workforce, with employees in rural, urban and remote locations. Transferability of these results is possible for other target populations with similar characteristics and working locations, in workplaces with the capacity to implement central coordination and policy direction to deliver programs tailor-made to suit employee needs. Results may be applicable in diverse organisational structures and within a political environment similar to Australia where implementing workplace health promotion is culturally accepted.

5.10.2 Limitations

No causal relationship between H@W and outcomes could be made due to the observational study design. The employer perspective does not account for employee out of pocket expenses that would increase the program costs nor community and other societal costs. The evaluative perspective was not broadened to include these costs due to large missing and heavily skewed out of pocket employee expenses data, and measuring challenges and constraints related to societal costs. Furthermore no opportunity costs (the best alternative use of the resources that funded H@W) were approximated. Although internal consistency of the organisational capacity measure was met, the measure has not been validated and a baseline measure of organisational capacity was unavailable. Five agencies reportedly offered health programs in some form prior to H@W. Prior implementation was captured in agency H@W program plans and upon review, and in considering process evaluation interviews and partner discussions, prior implementation did not show extensive activity or evaluation. Therefore all agencies were considered to start at the lowest organisational capacity level.

5.10.3 Conclusions

This study provided an economic evaluation of a workplace health promotion project from a state government (employer) perspective. The centrally coordinated organisational approach permitted quantification of an 'organisational capacity' measure that was used to gauge effectiveness. Other measures of interest included worker impacts (productivity and employee health and wellbeing) and community reach. Taken as a whole, no employee health status change in the TSS was seen over the four year time horizon, however employees within high organisational capacity agencies had lower total lost productive time than employees within low capacity agencies. This demonstrated a net saving to the TSS.

5.10.4 Source of funding

Funding for the study was provided through a research grant from the National Health and Medical Research Council Partnership Projects (Australia), grant no. 544954. There are no further financial relationships between funder and authors. The publication of study results was not contingent on sponsor's approval.

5.10.5 Conflicts of interest

None

5.11 Acknowledgements

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5.12 SO WHAT? Section

What is already known on this topic?

Economic evaluations can assist evidence-based decisions in WHP. Although traditionally economic evaluations identify measure and value outcomes arising from program activities, organisational culture plays a role in program success. In order to improve the breadth of evidence it is important for economic evaluations to consider outcomes of organisational capacity.

What does this article add?

This article presents an economic evaluation of an organisational approach to WHP in a public sector setting where improving culture was identified by decision makers as a valued intervention outcome. Agencies with higher organisational capacity demonstrated lower employee lost productive time. Value for money was evidenced from the organisational commitment to developing a healthier workplace.

What are the implications for health promotion practice or research?

Utilising a measure of organisational capacity to perform a comparative analysis better aligns economic evaluations with guidelines when the study design does not accommodate a comparator group. Furthermore, it integrates both individual and organisation-level measures simultaneously to broaden the evaluative scope and assessment of impact.

5.13 Summary

Purpose: To conduct an economic evaluation of a workplace health promotion project (Healthy@Work) in an Australian state government workforce.

Design: Prospective health economic cost-consequence analysis of an observational study from the employer (state government) perspective. Costs were reported in Australian Dollars (AUD), 2009 values (1AUD=0.89USD). Data sources: repeated cross-sectional surveys, audit surveys, administrative records.

Setting: Public sector agencies (n=14), Tasmania.

Subjects: 27,659 state service employees.

Intervention: Healthy@Work was an organisational workplace health and wellbeing project. Each agency was required to develop a plan for preventive strategies. The number and type of strategies varied across agencies.

Measures: Organisational capacity (workplace capability to support/encourage positive health choices); SF-6D health utility; absenteeism; presenteeism; lost productive time; healthcare utilisation.

Analysis: Cost-consequence analysis. Additionally, cost-benefit and cost-effectiveness analyses were performed with incremental net monetary benefit statistic to ascertain measure of uncertainty.

Results: The Tasmanian government invested \$2.04 million, \$74 per employee over 4 years (2008-2012). Upon project completion all agencies had developed and implemented workplace health promotion activities, one third reached high organisational capacity. Although no overall improvements in employee health was seen, decreased lost productive time in agencies of high organisational capacity saved \$1001 per employee per year compared to low capacity agencies.

Conclusion: Value for money was realised in improving organisational capacity, a necessary step on the path to improving employee health.

5.14 Postscript

There were some unique characteristics to this analysis. First, the use of an integrated mixed methods approach[51,52] pulled data together to form the measure of organisational capacity. The mixed methods 'matrix' allowed for the collection and utilisation of qualitative and quantitative data. Data were combined from both individual employee responses to the H@W program as well as agency personnel responses to the H@W processes. In so doing we showcased a method whereby disparate data sources could be combined. We recommend the use of mixed methods to evaluate the evidence, noting that new ways to measure value on investment is being sought and considered critical to success within the broader 'values' WHP paradigm.[78]

Second, the INMB statistic, although not fully able to be utilised in the analysis, was introduced. It offers an exciting economic methodological technique appropriate for measurement and evaluation in WHP at an individual employee level and within the scope of the value on investment CEA convention. "As collaboration grows between workplaces and research partners to evaluate the cost-effectiveness of new interventions, it will be critical for researchers to be aware of the latest methods for person-level analysis of cost-effectiveness data" p 441.[66]

Third, measuring organisational capacity is high on the WHP research agenda.[73] This analysis developed a measure that was specific to the organisation's vision and embodied their H@W model and key principles (Figure 5.1, Table 5.1). Although the measure was used to assess effectiveness, it mainly provided a unique way to assign a comparator group for the economic evaluation. An interesting finding yet one that was beyond the scope of this analysis was the characteristics of the employees within high capacity agencies, as they differed to those in low. They were more likely to be younger, male, working full time, with a higher proportion of managers and a higher mean annual salary. These characteristics may be an indicator of what type of working environments are more conducive to WHP implementation and further work to validate and test hypotheses are needed.

Expanding the scope of measurement and valuation in WHP has its evaluative challenges. Challenges that parallel those of complex public health interventions which similarly advanced from single to multifactorial, to whole of community, to inclusion and integration of environmental factors and policy.[79] These challenges include: diverse, non-linear, widespread, and protracted effects (benefits), valuation of non-health-related benefits, difficulties in causal attribution, complex contextual interactions (interventions implemented within varied operations, structures and relations), multiplier effects, and combined micro and macro-level variables.[75,76,80-83] It is thus essential for economic evaluations to seek new methods to not only address the expanded scope and value of WHP measurement but also the challenges inherent in its public health presentation.

This chapter assisted in this endeavour by acknowledging the emerging broader WHP value proposition, adopting the latest economic evaluative technique in WHP, and utilising a measure of organisational capacity to overcome the lack of a comparator in this observational study design. Moreover, our finding that higher organisational capacity demonstrated lower employee lost productive time, in combination with the finding in Chapter 4 (higher health utility was associated with lower absenteeism) indicates a probable connection could be explored between culture, productivity and health. As yet, a direct association between organisational culture and health is still to be determined.

5.15 References

1. Husereau D DM, Petrou S, Carswell C, Moher D, Greenberg D, Augustovski F, Briggs AH, Mauskopf J, Loder E,. Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement. *BMC Medicine.* 2013;11(80).

2. Terry PE. The industrial-strength tools needed for improving health promotion practice and fostering a shift to well-being. The Art of Health Promotion *The American Journal of Health Promotion.* 2015;July/August DOI: 10.4278/ajhp.29.6.tahp:TAHP-11-12.

3. Health at work network of the public health responsibility deal. http://www.dh.gov.uk/en/Publichealth/Publichealthresponsibilitydeal/index.htm

4. Department of Health_UK. The NHS Health and Well Being Improvement framework, Department of Health; 2011 http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_128813.pdf. 2011.

5. The European Network for Health Promotion (ENWHP). Publications available at http://www.enwhp.org/publications.html Accessed 10 April, 2015.

6. NHS;. Workplace Wellbeing Charter, National Award for England. http://wellbeingcharter.org.uk Accessed 5th December, 2014.

7. Patient Protection and Affordable Care Act. Subtitle D-Provisions Relating to Title IV. HR 3590 EAS/PP Available at http://www.hhs.gov/healthcare/rights/law/title/iv-amendments.pdf Accessed March 2014. 2010.

8. Australian Government Department of Health and Aging. National Partnership on Preventive Health (NPAPH) statement of commitment available at: http://www.healthyworkers.gov.au/internet/hwi/publishing.nsf/Content/joint-statement-toc.

9. World Economic Forum. The New Discipline of Workforce Wellness *Enhancing Corportae Performance by Tackling Chronic Disease*. 2010.

10. Baxter S, Sanderson K, Venn AJ, Blizzard CL, Palmer AJ. The relationship between return on investment and quality of study methodology in workplace health promotion programs. *Am. J. Health Promot.* 2014;28(6):347-363.

11. Lerner D, Rodday AM, Cohen JT, Rogers WH. A Systematic Review of the Evidence Concerning the Economic Impact of Employee-Focused Health Promotion and Wellness Programs. *J. Occup. Environ. Med.* 2013;55(2):209-222.

12. European Network for Workplace Health Promotion. Luxembourg Declaration on Workplace Health Promotion in the European Union, adopted on November 27-28, 1997 and updated in June 2005 and January 2007. Available at http://www.enwhp.org/fileadmin/rs-dokumente/dateien/Luxembourg_Declaration.pdf Accessed on 16 April, 2015.

13. World Health Organization. Health Promotion Glossary. *Division of Health Promotion, Education and Communications (HPR), Health Educations and Health Promtoion Unit (HEP) WHO/HPR/HEP/98.1* 1998.

14. Terry PE, Grossmeier J, Hudsmith N, Niebuhr S, Flynn J. The Art of Health Promotion ideas for improving health outcomes Editor's Desk: The Value Issue. *The American Journal of Health Promotion.* 2015;July/August DOI: 10.4278/ajhp.29.6.tahp.

15. Smith BJ, Tang KC, Nutbeam D. WHO Health Promotion Glossary: new terms. *Health Promot Int.* Dec 2006;21(4):340-345.

16. Health Enhancement Research Organization (HERO) and Population Health Alliance (PHA). Program Measurement and Evaluation Guide: Core Metrics for Employee Health Management Available at: http://hero-health.org/wp-content/uploads/2015/02/HERO-PHA-Metrics-Guide-FINAL.pdf Accessed April 2015. 2015.

17. Weiner BJ, Lewis MA, Linnan LA. Using organization theory to understand the determinants of effective implementation of worksite health promotion programs. *Health Educ. Res.* Apr 2009;24(2):292-305.

18. Allen J. Wellness Leadership. Burllington, VT: Healthyculture.com Publisher; 20082008.

19. van Dongen JM, van Wier MF, Tompa E, et al. Trial-based economic evaluations in occupational health: principles, methods, and recommendations. *J. Occup. Environ. Med.* Jun 2014;56(6):563-572.

20. O'Donnell M. *Health Promotion In The Workplace 4th edition.* 2015.

21. Department of Health and Human Services TSG. Healthy Workplace Resource Toolkit, available at www.tas.gov.au.

22. Health Promotion Board SG. Essential Guide to Workplace Health Promotion. Available at https://www.hpb.gov.sg/HOPPortal/health-article/HPBSUEXTAPP1_4021894 Accessed 10 April 2015.

23. HERO Best Practice Scorecard in collaboration with Mercer v. Available at: http://www.the-hero.org/scorecard_folder/scorecard.htm Accessed April 3, 2015.

24. Centre for Disease Control and Prevention. The CDC Worksite Health ScoreCare: An Assessment Tool for Employers to Prevent Heart Disease, Stroke, and Related Health Condtions. Atlanta: U.S. Department of Health and Human Services. Available at: http://www.cdc.gov/dhdsp/pubs/worksite_scorecard.htm. Accessed April 3, 2015. 2012.

25. Oldenburg B, Sallis JF, Harris D, Owen N. Checklist of Health Promotion Environments at Worksites (CHEW): development and measurement characteristics. *Am. J. Health Promot.* May-Jun 2002;16(5):288-299.

26. DeJoy DM, Wilson MG, Goetzel RZ, et al. Development of the Environmental Assessment Tool (EAT) to measure organizational physical and social support for worksite obesity prevention programs. *Journal of occupational and environmental medicine/American College of Occupational and Environmental Medicine.* 2008;50(2):126.

27. Golaszewski T, Barr D, Pronk N. Development of assessment tools to measure

organizational support for employee health. *American Journal of Health Behavior.* 2003;27(1):43-54.

28. Whitelaw S, Baxendale A, Bryce C, MacHardy L, Young I, Witney E. 'Settings' based health promotion: a review. *Health Promot Int.* Dec 2001;16(4):339-353.

29. Williams A. Health Economics: the cheerful face of a dismal science. In: Williams A, ed. *Health and Economics*. London: Macmillan; 1987.

30. Drummond MF, Sculpher MJ, Torrance GW. *Methods for the economic evaluation of health care programmes 3rd edition.* Oxford University Press, USA; 2005.

31. Weinstein MC, Siegel JE, Gold MR, Kamlet MS, Russell LB. Recommendations of the Panel on Cost-effectiveness in Health and Medicine. *JAMA.* Oct 16 1996;276(15):1253-1258.

32. Australian Government Department of Health. Pharmaceutical Benefits Advisory Committee (PBAC) Guidelines Available at http://www.pbac.pbs.gov.au/product-type-3/pt3.4-economic-evaluation.html Accessed on 5 May 2015.

33. Australian Government Department of Health. Medical Services Advisory Council (MSAC) Guidelines Available at http://www.msac.gov.au/internet/msac/publishing.nsf/Content/publications-lp-1 Accessed on March 2015.

34. National Institute for Health and Clinical Excellence. *The Guidelines Manual: Chapter 8; Incorportaing health economics in guidelines and assessing resource impact (April 2007)* http://www.nice.org.uk/niceMedia/pdf/GuidelinesManualChapter8.pdf. 2007.

35. Cass P, Weisel L, Møller T, Nissén M. The art of collaborative leadership: Through the art of hosting & harvesting conversations that matter. Paper presented at: Workbook for University of Tasmania workshops, August2011.

36. Robinson L. How to Change the World One Conversation at a Time: The Art of Hosting Action Conversations. Les Robinson and the Australian Conservation Foundation; 2010.

37. Tasmanian Government Department of Premier and Cabinet PSMO. *Healthy@Work Strategic Plan.* Hobart, Tasmania2009.

38. Queensland Health. Better health for Working People: Guidling Principles. In: QLD Health, ed. Brisbane, Australia1996.

39. Premier's Physical Activity Council. Get Moving at Work: A resource kit for workplace health and wellbeing programs Available at www.getmoving.tas.gov.au Accessed August 2014. 2007.

40. Workplace Health and Safety Queensland. Healthy Lifestyle Program for the Queensland Public Service: Guidelines for government agencies. Available at www.worksafe.qld.gov.au Accessed on August 2014. 2008.

41. Bellew B. Primary prevention of chronic disease in Australia through interventions in the workplace setting: a rapid review. *Sax Institute for the Chronic Disease Prevention Unit, Victorian Government Department of Human Services.* 2008.

42. World Health Organisation - Regional Office for the Western Pacific Regional guidelines for the development of healthy workplaces. Available at www.wpro.who.int Accessed June 2013. 1999.

43. Griffith University Centre for Population and Environmental Health. HealthyWork Professional Development Course Guide. 2010.

44. Australian Government Geoscience Australia. Area of Australia - States and Territories Availabel at http://www.ga.gov.au/scientific-topics/geographic-information/dimensions/area-of-australia-states-and-territories Accessed on 5 May 2015.

45. Australian Bureau of Statistics. *State and Territory Statistical Indicators Cat. No. (1367.0).* Canberra ACT: ABS2011.

46. Sanderson K, Tilse E, Nicholson J, Oldenburg B, Graves N. Which presenteeism measures are more sensitive to depression and anxiety? *J. Affect. Disord.* 2007;101(1):65-74.

47. Kessler RC, Ames M, Hymel PA, et al. Using the World Health Organization Health and Work Performance Questionnaire (HPQ) to evaluate the indirect workplace costs of illness. *J. Occup. Environ. Med.* Jun 2004;46(6):S23-S37.

48. Koopmanschap MA, Rutten FF, van Ineveld BM, van Roijen L. The friction cost method for measuring indirect costs of disease. *J. Health Econ.* Jun 1995;14(2):171-189.

49. Tasmanian State Government Department of Premier and Cabinet. Ministerial Direction 23 Guidelines: Implementing a Workplace Health and Wellbeing Program Available at http://www.dpac.tas.gov.au/__data/assets/pdf_file/0006/123855/Ministerial_Direction_23_Guidelines.pdf Accessed on 15 November, 2014.

50. Tasmanian State Government Department of Premier and Cabinet. Employment Direction 23: Workplace Health and Wellbeing. Available at http://www.dpac.tas.gov.au/__data/assets/pdf_file/0006/186036/ED23_WorkplaceHealthAndWellbeing.PDF Accessed on June 18, 2015.

51. Creswell JW, Klassen AC, Plano Clark VL, Smith KC. Best practices for mixed methods research in the health sciences. *Bethesda (Maryland): National Institutes of Health.* 2011:2094-2103.

52. Bazeley P, Kemp L. Mosaics, triangles, and DNA metaphors for integrated analysis in mixed methods research. *Journal of Mixed Methods Research.* 2012;6(1):55-72.

53. Linnan L, Bowling M, Childress J, et al. Results of the 2004 National Worksite Health Promotion Survey. *Am. J. Public Health.* Aug 2008;98(8):1503-1509.

54. Tasmanian Audit Office. *Auditor-General Special report No. 92. Public sector productivity: a ten-year comparison. Available at* http://www.audit.tas.gov.au/search/special+report *Accessed on Sept 2014.* Hobart: Parliament of Tasmania, Australia;2010.

55. Ware Jr JE, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey:

construction of scales and preliminary tests of reliability and validity. *Med. Care.* 1996;34(3):220-233.

56. Brazier JE, Roberts J. The estimation of a preference-based measure of health from the SF-12. *Med. Care.* 2004;42(9):851-859.

57. Baxter SS, K Venn, A Otahal, P and Palmer, AJ;. Construct validity of SF-6D health state utility values in an employed population. *Qual. Life Res.* 2015;24(4):851-870.

58. Tasmanian Government Department of Premier and Cabinet PSMO. *People Directions: delivering quality services for Tasmanians.* Hobart, Tasmania2009.

59. Kilpatrick M, Sanderson K, Blizzard L, Teale B, Venn A. Cross-sectional associations between sitting at work and psychological distress: reducing sitting time may benefit mental health. *Mental Health and Physical Activity.* 2013;6:103-109.

60. Jarman L, Martin A, Venn A, et al. Prevalence and correlates of psychological distress in a large and diverse public sector workforce: baseline results from Partnering Healthy@ Work. *BMC public health.* 2014;14(1):125.

61. Kilpatrick MB, C.L. Sanderson, K. Teale, BC. Venn, AJ., . Factors associated with availability of, and employee participation in, comprehensive workplace health promotion (WHP) in a large and diverse Australian public-sector setting: a cross-sectional survey. *J. Occup. Environ. Med.* In press.

62. Australian Bureau of Statistics. Consumer Price index Cat 6401.0 Available at http://www.abs.gov.au/ausstats/abs@.nsf/mf/6401.0 Accessed on April 2015.

63. Nutbeam D. Evaluating health promotion—progress, problems and solutions. *Health Promot Int.* 1998;13(1):27.

64. Hoch JS, Briggs AH, Willan AR. Something old, something new, something borrowed, something blue: a framework for the marriage of health econometrics and cost-effectiveness analysis. *Health Econ.* Jul 2002;11(5):415-430.

65. Briggs AH, O'Brien BJ, Blackhouse G. Thinking outside the box: recent advances in the analysis and presentation of uncertainty in cost-effectiveness studies. *Annu. Rev. Public Health.* 2002;23:377-401.

66. Hoch JS, Dewa CS. Advantages of the net benefit regression framework for economic evaluations of interventions in the workplace: a case study of the cost-effectiveness of a collaborative mental health care program for people receiving short-term disability benefits for psychiatric disorders. *J. Occup. Environ. Med.* Apr 2014;56(4):441-445.

67. O'Donnell MP. What Is the ROI for Workplace Health Promotion? It Really Does Depend, and That's the Point. *Am. J. Health Promot.* 2015;29(3):v-viii.

68. Tasmanian State Government Department of Premier and Cabinet. Healthy@Work: Project Review and Closure Report. 2012.

69. ANZSCO. Australian and New Zealand Standard Classification of Occupations (ANZSCO), First edition, 2006 (ABS Cat. No. 1220.0). 2006.

70. Walters SJ, Brazier JE. What is the relationship between the minimally important

difference and health state utility values? The case of the SF-6D. *Health and quality of life outcomes.* 2003;1(1):4.

71. McDaid DN, J. *What use has been made of economic evaluation in public health? A systematic review of the literature.* Dawson, S. Morris, ZS. editors Future Public Health: Burdens, Challenges and Opportunities. Basingstone: Palgrave Macmillan.

72. National Institute for Health and Clinical Excellence. Methods for development of NICE public health guidance. Second edition NICE London. Available at http://www.nice.org.uk/media/2FB/53/PHMethodsManual110509.pdf Accessed May 2015. 2009.

73. Connor MF, EM. Umland, B. Anderson, D. Alexander, G. Brennan, M. Flynn, J. Grossmeier, J. Hamlin, B. Juster, I. Kaplan, G. Long, A. Nelson, C. Palma-Davis, L. Palmer, R. Srivastava, P. Veroff, D. Noyce, J. Moseley, K. Damsker, M,. The Art of Health Promotion ideas for improving health outcomes Editor's Desk: The Measurement Issue. *Am. J. Health Promot.* 2014;28(4 (TAPH)).

74. Grossmeier J, Terry PE, Cipriotti A, Burtaine JE. Best practices in evaluating worksite health promotion programs. *Am. J. Health Promot.* Jan-Feb 2010;24(3):TAHP1-9, iii.

75. Shiell A, Hawe P, Gold L. Complex interventions or complex systems? Implications for health economic evaluation. *BMJ.* Jun 7 2008;336(7656):1281-1283.

76. Eckermann S, Dawber J, Yeatman H, Quinsey K, Morris D. Evaluating return on investment in a school based health promotion and prevention program: the investment multiplier for the Stephanie Alexander Kitchen Garden National Program. *Soc. Sci. Med.* Aug 2014;114:103-112.

77. Saha S, Gerdtham U-G, Johansson P. Economic evaluation of lifestyle interventions for preventing diabetes and cardiovascular diseases. *International journal of environmental research and public health.* 2010;7(8):3150-3195.

78. Niebuhr S, Grossmeier J. Is it time for a broader approach? Recasting the value of "employee health" with a focus on workforce capability. The Art of Health Promotion *The American Journal of Health Promotion.* 2015;July/August DOI: 10.4278/ajhp.29.6.tahp:TAHP-6-9.

79. Eriksson C. Learning and knowledge-production for public health: a review of approaches to evidence-based public health. *Scand J Public Health.* Dec 2000;28(4):298-308.

80. Rickles D HP, Shiell A. A simple guide to chaos and complexity. *J. Epidemiol. Community Health.* 2007;61:93-97.

81. Rychetnik L, Frommer M, Hawe P, Shiell A. Criteria for evaluating evidence on public health interventions. *J. Epidemiol. Community Health.* Feb 2002;56(2):119-127.

82. Shiell A, Hawe P. Health promotion community development and the tyranny of individualism. *Health Econ.* May-Jun 1996;5(3):241-247.

83. Lorgelly PKL, K.D. Elisabeth A.L. Fenwick, E.A.L. and Briggs, A.H. Outcome

Measurement in Economic Evaluations of Public Health Interventions: a Role for the Capability Approach? *International Journal of Environmental Research and Public Health Monograph.* 2010;7:2274-2289.

Appendix 5A: Questions within the 2013 *p*H@W survey testing internal consistency of organisational capacity measure

How far do you agree or disagree with the following statements?		1 Strongly agree	2 Agree	3 Disagree	4 Strongly Disagree
27	I feel proud when I tell others I am part of my organisation	O	O	O	O
28	I would recommend my organisation a great place to work	O	O	O	O
29	I feel a strong personal attachment to my organisation	O	O	O	O
30	My organisation inspires me to do the best in my job	O	O	O	O
31	My organisation motivates me to help it achieve its objectives	O	O	O	O

% response of employees agreeing or strongly agreeing to all 5 statements
46% High capacity Agencies
37% Low capacity Agencies

Mean number of questions employees responded with 'agree' or 'strongly agree' for agencies of high, middle and low organisational capacity

Capacity	Mean	Std. Err	Lower 95% CI	Upper 95% CI
High	3.39	0.07	3.24	3.53
Middle	3.39	0.05	3.29	3.49
Low	2.98	0.05	2.88	3.09

Linear regression analysis to show relationship between capacity and positive employee response

Capacity	β	Std. Err.	Lower 95% CI	Upper 95% CI
High	ref			
Middle	0.00	0.10	-0.18	0.18
Low	-0.41	0.10	-0.59	-0.23

Linear trend $p<0.01$

35. a) Please indicate how you feel about the following statements, even if you *did not* take part in any of the activities or programs listed in question 33.

	Strongly agree	Agree	Disagree	Strongly disagree
I was consulted in the design of the activities	○	○	○	○
I have the support of my managers to take part	○	○	○	○
My organisation places a high priority on these activities	○	○	○	○
My co-workers were interested in taking part	○	○	○	○
The activities offered can improve my health and wellbeing	○	○	○	○
35. b) In general, the activities were:				
Well publicised	○	○	○	○
Relevant to my needs	○	○	○	○

% response of employees agreeing or strongly agreeing to all 7 statements
18% High capacity Agencies
9% Low capacity Agencies

Mean number of questions employees responded with 'agree' or 'strongly agree' for agencies of high, middle and low organisational capacity

Capacity	Mean	Std. Err	Lower 95% CI	Upper 95% CI
High	3.80	0.09	3.62	3.97
Middle	3.16	0.06	3.05	3.28
Low	2.99	0.06	2.88	3.10

Linear regression analysis to show relationship between capacity and positive employee response

Capacity	β	Std. Err.	Lower 95% CI	Upper 95% CI
High	ref			
Middle	-0.63	0.10	-0.84	-0.43
Low	-0.81	0.11	-1.01	-0.60

Linear trend p<0.01

Appendix 5B: Method for estimation of minimally important difference of the SF-6D in the Australian employee

Objective: To determine the minimal important difference (MID) of the SF-6D health utility in an employed population using the SF-36(version 1).

Methods: An anchor-based approach was utilised to investigate the MID and the difference in health utility values which corresponded to a small but important health change on a self-reported global rating of change (GRoC) scale. Data was obtained from the Household, Income and Labour Dynamics in Australia (HILDA) longitudinal study of persons residing in private dwellings in Australia which commenced in 2001. Respondents were employed individuals who completed the SF-36v1 questionnaire for any one year period across Waves 8 (n=), 9 (n=), 10 (n=), and 11 (n=) of HILDA. For further analysis, individuals were classified into Private Sector or Public Sector employment categories. The GRoC score was derived from question 2 of the SF-36v1 (which was not used to generate SF-6D utility values); compared to one year ago, how would you rate your health in general now 1) much better than a year ago 2) somewhat better now than a year ago 3) about the same as one year ago 4) somewhat worse now than one year ago 5) much worse now than one year ago. Individuals who scored either a 2 or 4 GRoC score were considered to have experienced the equivalence of a MID health change. For individuals who scored either a 1 or 2 GRoC score (i.e. a worsening of health) their SF-6D health utility value sign was reversed (i.e. multiplied by minus one). Mean change in the SF-6D health utility values for individuals reporting health change (GRoC score of 2 or 4) represented the MID. Sensitivity analysis using the effect size (SRM) and half a standard deviation was also performed.

The mean MID was calculated as: 0.02318028

Global rating of health scale*	n	MID^	SE	95% CI
Better than a year ago	762	0.028	0.003	0.02, 0.03
Same as a year ago	4417	0.001	0.001	0.00, 0.00
Worse than a year ago	590	0.048	0.005	0.04, 0.06

* Global rating of health scale is question 2 of the SF-36 and is not part of the SF-6D.

^ The minimally important difference, the difference between the quality of life scale corresponding to a self-reported small but important change on the global rating of health scale

For further explanation for calculating MIDs refer to Walters et al. [70]

6 Chapter six: Discussion

6.1 Preface

The aim of this thesis was **to investigate the application of health economics to evaluate workplace health promotion**. It began with an overview of workplace health promotion (WHP); its evolution linked to our understanding of the multi-determinants of health, its drive from a public health approach, its recognition within economic development on a macroeconomic scale and its importance for the business case at the organisation level. The research presented has focussed on the use of health economics to conduct microeconomic evaluations in WHP; a review of health economic evaluations (Chapter 2), a business case tool (Chapter 3), and validation of a multi-attribute utility instrument to measure employee health status (Chapter 4). The knowledge gained through these works on quality and measurement culminated in an economic evaluation of the Tasmanian state government Healthy@Work (H@W) project (Chapter 5).

In this Discussion Chapter, implications of the economic evaluation of the four-year whole-of-state service workforce WHP project, along with cumulative understandings from these other works are presented. It is written with reference to sustainability. The future direction of applied health economics in WHP will be contemplated, with appreciation of the relative infancy of economic evaluations in WHP, as well as considering the difficulties and methodological challenges that arise. The validity of “the bottom line” will also be addressed. This Chapter will provide some key conclusions drawn from the work presented and the literature, and offer recommendations to the research community, employers and public sector employers, including the Tasmanian Government, to optimize the chances of a sustainable future for WHP.

6.2 Sustainability of WHP – the need for research like this

Sustainability of WHP is the likelihood that programs and projects will continue to function effectively after initial implementation ends.[1] The need for sustainability of WHP is great.

- Global mortality is being driven by non-communicable 'chronic' diseases like cardiovascular disease, diabetes, chronic respiratory disease and cancer.[2]
- Tobacco use, poor diet, sedentary lifestyle and excessive alcohol consumption are the four underlying risk factors responsible for half of all chronic diseases.[3]
- Adopting a healthy lifestyle is associated with reduced mortality risk[4] and
- WHP supports healthy lifestyle choices and has been shown to decrease chronic disease.[5]

In Australia in 2012, chronic disease accounted for an estimated 10,017 years of life lost per 100,000 people; 84% of all causes: communicable, non-communicable and injuries.[2] Despite the high burden of chronic disease and the understanding that the workplace is a priority setting to address this burden, commitment to WHP is currently lacking within Australian federal government policy. In contrast, the UK includes improving healthier working environments in their action framework to reduce early retirement[6] and grants are available in the Unites States for employers who provide access to "comprehensive workplace wellness programs" p2285 of HR 3590 EAS/PP, line 19. [7] Implementation and any subsequent sustainability of WHP in Australia is the role of the Australian employer.

6.2.1 But it wasn't always this way: When the Australian political tide turned towards WHP ….or not!

During the life of my candidature a perplexing example of failure in federal government commitment occurred. The following example illustrates the insecurity of sustainability efforts and significance of health economic research in WHP.

Historically, the Australian national public health effort in relation to the well-being of our workers has focussed on occupational health and safety rather than health promotion.[8] Yet the tide turned in 2009 with the largest federal commitment of funding and resource for WHP within The National Partnership Agreement of Preventive Health (NPAPH) and the Australian National Preventive Health Agency (ANPHA) (detailed in Chapter 1). Disconcertingly, these prevention bodies and functions ceased operations in July 2014, four years earlier than planned. A change in federal government saw value placed on other health spending over prevention,[9] despite the expected impacts from health promotion reflecting the highest long-term returns on investment (ROI).[10,11] Shifting tides such as these reflect the limitation of finite public resources but also lacklustre and fickle health promotion commitment. It is known that many factors can impact the decision-making process;[12] one factor that relates to my work in Chapter 2 is the provision of quality economic evidence to empower and inform.

6.2.2 Of concern to our partners

At the local Tasmanian level, there were no ongoing plans or centralised funding for Healthy@Work (H@W) beyond its initial implementation period (2008-2012). The sustainability of H@W will rely on the built capacity for health promotion at the individual organisation (agency) level. WHP resources, expertise, and infrastructure will all remain within individual agencies. In order for H@W to be sustainable, agency heads will need to recognise the worth of maintaining and supporting their individual WHP programs. There is also evidence that partnerships can help build capacity[13] and possibly the research conducted within *partnering*H@W (including this thesis work) may feature in the sustainability effort.

6.3 Improving the evidence-base in WHP

Chapter 2 provided economic evidence in WHP from a quality-based systematic review. Another factor that can be critical to sustainability, and advocated in evidence-based decisions for public policy and professional practice, is having economic evidence to inform decisions.[14] The analysis responded to the caution expressed by the research community regarding the influence of the strength of evidence on financial outcomes in WHP, and the continual call for analyses to adequately consider economic methodological quality. The published review (Chapter 2 Appendix 2A) applied rigorous and systematic methods to search for economic evidence in WHP. It aimed to assess the economic methodological quality using quality checklists and determine the ROI when accounting for quality. In summary, economic evidence in WHP is generally low to moderate quality. Studies have not adopted optimal health economic methodologies for economic evaluations. Specifically in their 1) design (mostly retrospective) 2) reporting standards (especially poor with respect to analysis and interpretation) 3) measurement (mostly limited to absenteeism and medical care cost) and 4) valuation methods (non-standardised and non-validated). Additionally, many economic studies were excluded from the review as they did not include all the components of a full economic evaluation; costs and benefits of a WHP intervention alongside a comparator.

As a result, economic evidence in WHP has previously tended to over-estimate economic benefits, lack transparency, not fully assess uncertainty and is rarely reproducible. This may minimise the value of analyses for decision makers. Additionally and equally as crucial, it decreases the presence of WHP research within Cochrane-endorsed public registries, economic databases and online ‘evidence libraries.’[15-19] This dearth of evidence does little to assist decision making and commitment to WHP. Yet the demise cannot solely be placed on economic methodological quality. There are inherent difficulties in performing experimental design in health promotion.[11,20-22] This can account for some of the limitations in WHP economic evidence generation and availability. Furthermore, the definition of ‘health promotion evaluation’ itself “an assessment of the extent to which health promotion actions achieve a ‘valued’ outcome” p12 [23] indicates how context-sensitive WHP interventions should be. This definition can thwart evidence generalisability and transferability as it highlights the need for varied evaluative designs within diverse populations and settings under both controlled (‘Can WHP work?’) and ‘real-world’ (‘Does WHP work?’) scenarios. Moreover, and in consideration that ‘health promotion outcomes’ represent “changes to personal characteristics and skills, and/or social norms and actions, and/or organizational practices and public policies which are attributable to a health promotion activity,” p12 [23] outcomes are vast and variable, achieved over considerable time and by nature of design, difficult to attribute to the WHP intervention alone. WHP has a myriad of complexity within its evaluative scope.

As a result of these complexities, economic analyses need to be transparently reported. Putting differences between health promotion and clinical interventions aside, the purpose of an economic evaluation should offer robust information to inform decisions. The review suggests adopting the Consolidated Health Economic Evaluation Reporting Standards (CHEERS)[24] to guide evaluation content and assist WHP evidence reporting. CHEERS guidelines purports to be “neutral about the conduct of economic evaluation, allowing analysts the freedom to choose different methods” p246. [24] This view supports its appropriateness for WHP where conducting cost-effectiveness analyses have traditionally been a less-common pursuit.

6.3.1 Improving the evidence quality for business decision making

A lack of trustworthiness in the reported bottom line can create a lack of understanding of the benefit in WHP. A lack of understanding has been reported as one of the most common barriers to employer commitment.[25] Seemingly unrealistic high returns and evidence contradictions has a knock on effect for whether WHP programs are adopted and/or sustained, for they generate evidence fatigue and scepticism.[26] An Australian example: an Executive of a large Australian company when asked why he declined to offer employees a workplace mental health screening and early intervention program (no cash contribution by employers required) remarked as his reason to decline “If I instigated all the programs to increase productivity, we would be working at 1,000% above current capacity” p514. [26]

Our review in Chapter 2 demonstrated overall mean weighted ROI of high quality evidence in WHP to be positive and provided the most comprehensive summary estimate of financial return to date. Although financial outcomes are only one of many domains of evaluation on WHP effectiveness, it will remain an important and inherent part for business justification into the future.[27] Improving the methodology for how we conduct and report economic evaluations in WHP may help decrease evidence fatigue, increase utility of the financial outcomes for policy and business and work towards improved sustainability.

Recommendations arising from Chapter 2:

- A potential solution to overcoming evaluative complexities is to follow economic principles in health economic evaluations by naming convention and reporting standards.
- Weaknesses in methodological quality can impede evidence that may be used to support funding decisions. Therefore progression in the state of economic evidence in WHP can occur if evaluators: 1) Collect economic data alongside health and other effectiveness data prospectively; 2) Collect data on both costs and benefits of the intervention and the comparator to ensure the evaluation has the components of a full economic evaluation; and 3) Perform an incremental analysis.
- Broader measures for health and non-health costs and consequences wherein economic value can be placed need to be considered. Employer costs that consider community-level outcomes needs better representation in WHP evaluations. Identifying, measuring and valuing WHP from a societal perspective will produce a greater depth of impact of WHP beyond the individual employee/company level.
- Create a WHP repository of high-quality evidence to assist greater availability of evidence for decision makers.
- To truly meet the public health objective of WHP, studies should consider measuring health inequalities. The impact of WHP on health inequalities was not represented in the review. Equity outcomes further encompass adopting a broader health economic scope, yet arguably are inherently important for optimizing the health of workers.

6.4 Improving the measurement of health in WHP

The research in Chapter 4 met the identified need for broader measures of health to be available for economic evaluations in WHP. It investigated the construct validity of a measure of health utility (SF-6D) in the employee population.

When considering the significance of this analysis it is important to consider some assumptions that underlie the measurement of worker health. First, worker health behaviour is voluntary and requires a participatory process involving individuals stakeholders and partnerships.[28] Second, worker health is influenced by multi-determinants[29,30] (individual, environmental, social, political, organisational including work styles, practices, work groups, culture, and physical and working conditions). Third, health is multidimensional and a major component of quality of life.

Figure 6.1 offers a pictorial representation of the significance of quality of life in health promotion. Published evidence suggests employer wellbeing programs can improve quality of life.[31]

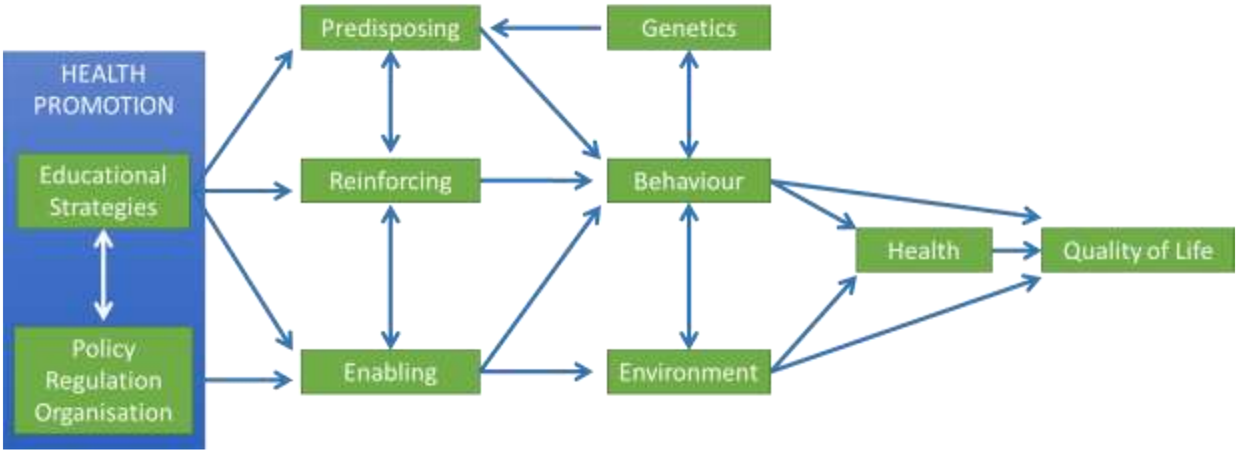

Figure 6.1 Quality of life: the ultimate health outcome, as depicted by part of the precede-proceed public health model of health promotion[32]

Health-related quality of life instruments are multi-item scales that measure domains of health, from where multi-attribute utility instruments (MAUIs) like SF-6D derive health utility.[33] The analysis in Chapter 4 validated the SF-6D measure of health utility in the employee population. Health utility is a single index of health status. It reflects people's preference for different health states using preference scores based on community-derived weights. The analysis found worker SF-6D health utility values appropriately measured across gender and appropriately discriminated between health factors (comorbidity, body mass index, psychological distress, age), socioeconomic factors (salary, in populations within private enterprise), and work characteristics (job stress, absenteeism, employment condition and occupational type). Furthermore SF-6D did not demonstrate a ceiling effect in the working population.

There are many important implications for this work.

1. Improving employee health is an inexorable mission of WHP and the ability to validly measure health status is of utmost relevance to the field.
2. A health utility derived from a health-related quality of life measure is advantageous as it innately places value on health. Therefore this work not only provides a valid measure to assess health status of employees, it provides evaluators with a measure that fulfils the identification, measurement and valuation principle of health economic evaluation. Placing value on measures in WHP was found in the review (in Chapter 2) to be most lacking.
3. A valid measure of health that has the ability to be valued through monetization will allow a clear articulation of health in the business case. The advantage that health utility can be woven into the dialogue of a company's bottom line assists sustainable business discussions in WHP. This will meet the need for common definitions and a set of metrics for the measurement of health relevant for business, the need to define health beyond medical care, and the importance to have outcomes that can "speak the language of profit" p 9. [25]
4. The measure of health status using health-related quality of life helps to better align economic evaluations of WHP with the health economic discipline. For without defining "what is health?" it is methodologically flawed to attempt to analyse impacts on health, demands for health and so on. The disciplinary importance was represented in the schematic presentation of health economic elements in the introduction.[34]
5. Evaluators (with policy stakeholders) have the ability to utilise health utility alongside another health outcome measure, life expectancy, to achieve a combined single index measure known as quality adjusted life years (QALYs). Although economic guidelines endorse QALYs as the gold standard measure of health,[35] it is not yet known whether the valuation of employee health by QALY measurement offers utility for employers. Nonetheless, the inclusion of health utility in the WHP economic evaluation toolkit permits comparative cost-utility (cost-effectiveness) analysis to report incremental cost per QALY. This health outcome measurement is in line with policy standards[14] and allows the potential for WHP interventions to compete for healthcare resources.

Recommendations arising from Chapter 4 are:

- Adopting a common metric for health that is valid in employee populations and that is amenable for use in economic evaluations and financial analysis is needed. Health utility SF-6D is proposed as the appropriate measure.

- Measuring health status follows economic principles in health economic evaluations and as health is an integral outcome in health promotion, health should be considered as a prerequisite measure in all health economic evaluations in WHP.
- It has become clear in my work, my conference attendances and reading for this thesis that health is an important consideration for employers. Workplaces interested in WHP do look beyond just workplace productivity. As such, and beyond economic principles themselves, identifying, measuring and valuing health provides evaluative diligence.
- For application in policy: Worker health utility and employee life expectancy can combine to produce a QALY. WHP economic evaluations that can produce QALY-based incremental cost effectiveness ratios (ICERs) will allow for WHP interventions to be ranked accordingly within QALY league tables. In so doing WHP can better compete for funding in resource allocation decisions. It should be noted that QALYs are most utilised in health sector decision making within league tables for health economic decision rules. Again, it is unknown if this measure offers utility for employers.

6.5 Informing decisions on the Healthy@Work (H@W) project

The research in Chapter 5, a partner-driven economic evaluation of H@W, builds from these previous works on economic evidence development (can WHP provide value for money?) and on valuation of health (what measures better define employee health that can have assigned value?). The analysis was an economic evaluation conducted in collaboration with the Tasmanian State Service decision makers to answer the question “Was H@W good value for money?”

H@W was a four-year commitment by the Tasmanian Government to implement WHP over their entire public service workforce. It was developed to support the health and wellbeing of public sector public service workers working within healthier workplaces, using evidence-based WHP best practices, and implemented through a co-ordinated organisational approach. Economic forms considered within the analysis were cost-benefit analysis, cost-utility analysis and cost-consequence analysis. Cost consequence analysis was considered the only appropriate form given there was no change in health status across the intervention years and comparator groups. The demonstrated large ROI ratio from the cost-benefit analysis was an inadequate measure of value for money; in part due to concerns that large intervention populations produce consequentially small program costs (ensuring a very small denominator within the ratio).[36] Moreover, total lost productive time was the only measured benefit that produced the ROI, and therefore the ratio represented value for money solely from a productivity outcome. This is against Australian economic evaluation guidance[37] which suggests reporting results with and without production consequences to minimise labour market biases.

Implications for this work will be more fully known into the future when decisions regarding H@W are discussed by the decisions makers after the economic evaluation is presented. At this time the H@W project has ceased as originally planned and sustainability will be driven primarily by individual agencies.

Following health economic principles for a comparator population did present difficulties as no control group existed. This was overcome to some extent by considering the value of organisational capacity and stratifying the Tasmanian State Service employee population into those working within high versus low capacity agencies. Measuring and utilising organisational capacity in this way was novel yet posed design issues, as no baseline measure and no change over time attributable to H@W was possible. The cross-sectional analysis however, demonstrated differences in the employee absenteeism and presenteeism outcomes. Furthermore, efforts to provide internal consistency of the measure showed that employee perceptions of culture, personal attachment and attitudes to their organisation were higher in high capacity workplaces and these were statistically significant. Although still in its infancy, measuring organisational capacity is recognised in the literature as a crucial step towards improving worker health.[38] By improving the organisation we may improve factors contributing to the multi-determinants of worker health, create environments with better accessibility to healthy living, and enhance individual worker efforts to choose healthy behaviours.

The analysis in Chapter 5 presents a practical use of a measure of organisational capacity in an economic evaluation. In so doing it attempted to measure health promotion outcomes that can occur in a shorter time frame compared to health outcomes and therefore may demonstrate an early impact. It also helped address the multi-focus complexity of improving workplaces beyond the conventional individualistic lifestyle-approach. Moreover it attempted to create a comparator within a study design without a control group in order to maintain a fundamental health economics principle to provide an incremental analysis.

Recommendations arising from Chapter 5 are:

- Implementation of workplace health promotion should consider adopting a Stepped Wedge Trial Design Approach.[39,40] This approach would help to address some complexities inherent in WHP and its economic evaluations. By implementing a (randomised) sequencing approach to WHP intervention roll out, a stepped wedge design trial can i) provide comparisons in organisation-wide delivery when no natural comparator exists, and ii) allow the observational design suited to WHP to gain improved experimental evidence. Furthermore as expected effectiveness occurs over a considerable length of time in WHP, effect of time on outcomes can be modelled.[41] So too, this approach could assist in detecting points of success or failure by distinguishing between the fidelity of the evaluation process and the intervention itself. Such evidence in public health interventions is lacking.[21] A stepped wedge approach has been endorsed in the Medical Research Council guidance for use in complex interventions.[42]

- Use the Consolidated Health Economic Evaluation Reporting Standards (CHEERS). Although concerns exist that they are better suited to pharmacoeconomic evaluations it was found that the guidelines offered a blueprint for inclusion of all important components of an economic evaluation. Adoption of this guidance will improve the transparency of reporting.
- The incremental net monetary benefit framework is appropriate for use in economic evaluations of WHP for analysis of uncertainty where the cost-effectiveness threshold value is unknown.[43,44]
- Employee health status is a final long term outcome and requires lengthy follow-up periods to assess impact. Evaluating health status requires sustainable commitment to the intervention in order to assess future changes that may be realised. Intermediate outcomes of health must also be considered for interim evaluations. Consideration should be given to the modelling of health status in order to evaluate effect and translate final outcomes when intervention durations are short.
- As WHP impacts multiple levels (individual, organisation, community) outcomes from each level should be included in evaluations. Capturing outcomes at the broader levels including changes in structures, policies, built environment, capacity requires novel methods to be considered. Integrating both quantitative and qualitative data is required and using a mixed methods analysis approach is one possible direction.

The *partnering*Healthy@Work project provided insights into the processes and evaluation needs when implementing an organisational WHP initiative. It also allowed for strength in partnership between policy and research to be developed. At the time of the economic analysis there was no definitive evidence to show the investment was financially worthwhile. Not an unexpected result, considering the short-term length of the project and the long-term outcome measure of health status.

Recommendations specific to partners

- It is recommended that the TSS internal agency audit be continued and collected annually so that ongoing organisational capacity and sustainability efforts are measured and available for possible future monitoring of impacts.
- Consulting with researchers/health economists <u>before</u> implementation will undoubtedly strengthen evaluative efforts by ensuring an improved study design and the use of most appropriate and valid measures.
- Policy-research partnerships should be encouraged as they provide multidisciplinary strength that suits the integrative needs of economic evaluations in WHP.
- It is recommended that the Tasmanian Government develop guidelines for incorporating economic evidence into policy. Guidelines make provisions for a broader scope of scientific evidence appropriate to public health evaluations. Infrastructure to support better systematic use of evidence will assist the allocation of funding in accord with best evidence-based knowledge. Evidence of opportunities and obstacles in facilitating such a process are available.[45]

6.6 A resource to assist in sustainability efforts

Non-lasting commitment to WHP delivery threatens sustainability and any gained benefits towards improved population health. So far the analyses have recommended for economic evaluations in WHP to address areas that jeopardise measurement, methodology and transparent reporting. Many of these threats are the direct result of challenges inherent in public health interventions. Yet it is also prudent to consider factors such as the healthy worker effect that directly influences studies on workers in relation to study design and evidence generation comparative to the general population. Epidemiological studies must account for the healthy worker effect considering "workers tend to be healthier as a group, and hence less susceptible to morbidity and premature mortality, than the general population" p 276. [46]

6.6.1 Challenges facing economic evaluations in WHP

1. Diverse, non-linear, widespread, and protracted effects (benefits)

2. Difficulties in assigning causality and attribution to WHP due to study design and benefit latency

3. Difficulties in identifying, measuring and valuing the interdisciplinary multi-focus and complex contextual interactions that result in a broad number of outcomes and

consequences that are non-health related and beyond the targeted individuals

4. Difficulties in generalisation due to contextual nature of evaluations

5. Methodological difficulties and lack of reporting standards

6. Whole-of-organisational approach decreases opportunity for comparator populations

Despite these challenges affecting the evidence base in WHP, resources are needed and continue to be developed to help engage business interest. The analysis in Chapter 3 is an example of a business tool. Resource development was undertaken through an internship within the Tasmanian Department of Health and Human Services, an outcome of the unique research-policy partnership *partnering*Healthy@Work. The resource known as the 'Workplace Health Savings Calculator' has been available online within the Australian federal government workplace health toolkit since 2013 and has been adapted and reproduced in other Australian states by non-government and state government bodies. Interest in the calculator to assist engagement of business in WHP has been demonstrated. There are some implications from this work.

The methodology considers the business case relating to absenteeism and staff turnover as the only outcome measures. Benefits are quantified in dollar terms and expected savings presented. There was no capability within the algorithm to produce a return on investment figure. These considerations were made and defended due to the short time frame the resource needed to be developed in, the state of the evidence at the time, the measures routinely captured by Australian businesses (a high proportion of organisations from the small-to-medium sector), and the utility of the tool to engage rather than evaluate program delivery.

Recommendations arising from Chapter 3 are:

- Policy-research partnerships are a great breeding ground for innovation and opportunity for translating research into policy.
- Researchers must be prepared to work under the constraints of policy deadlines which may not always provide enough time for thorough investigation. These limitations must be considered and acknowledged within the outcomes developed.

6.7 A look into the future

Change in how economic evaluations will be conducted in WHP over the coming years has already begun. The following discussion is a comment on an emerging economic framework in WHP. It has been developed in the Unites States of America (USA) in response to a policydirective. It is highlighted so as to demonstrate with greater clarity and broader understanding the value that WHP can produce.

In Australia, the development of WHP as a priority setting has been driven by public health and etched from the work of Australian researchers within World Health Organization Collaborating Centres and Schools of Public Health.[1,28,47,48] There are many Australian researchers performing health economic evaluations of health promotion interventions[12,49-55] and investigating health economic applications suitable for the workplace setting.[22,56-70] However, most of the financial evidence in WHP is conducted in the USA (see Chapter 2). American scholars have been focussed on the WHP research for decades [71] with financial analysis of WHP interventions spurred on by increasing business costs within the provider-pay health care system. Today in the USA the Patient Protection and Affordable Care Act[7] encourages businesses to implement “comprehensive workplace wellness programs.” Comprehensiveness is “based on and consistent with evidence-based research and best practices, including research and practices as provided in the Guide to Community Preventive Services and the National Registry for Effective Programs.” (Section 10408 p 2285-86[7]) This criterion has impelled WHP scholars to consider ways to measure effectiveness so as to better align the WHP initiative of America with public health goals of sustainable community development and public (evidence-based) policy.

Therefore the WHP paradigm is shifting in search of higher quality, more relevant evidence that can capture its integrative processes. This window of opportunity has been embraced. The Health Enhancement Research Organisation (HERO) and Population Health Alliance (PHA) have collaborated to develop a set of core (and consistent) measures so that WHP programs transition to data-driven health improvement processes. These include: Financial outcomes, Health impact, Participation, Satisfaction, Organizational support, Productivity and performance.[27] The evidence generated from the USA from approaches like these will most assuredly inform Australian WHP efforts into the future.

6.7.1 An emerging economic framework within WHP

Sitting within the HERO-PHA model is a seventh essential measurement for program success: Value on investment (VOI). This framework is being operationalised by the following[72]:

1. Calculation of input costs – direct and indirect
2. Consider and review the full range of possible outcomes. Are they salient? Measureable? Of importance to company values and culture?

3. Determine measurement rigor for potentially monetized outcomes

4. Compile the outcome measures, integrating appropriate coefficients for precision and priority

5. Create appropriate Cost Effectiveness Analysis (CEA) ratios – total program costs per outcome unit

This framework holds promise, offering a unified approach to financial analysis. It aims to identify and measure costs and consequences. It has some essential components of an economic evaluation. However, what it lacks could hinder the methodological quality of economic evidence that arise from it. It lacks the inclusion of a comparator, and the integration of how value is placed on the measurements. Furthermore, the creation of a simple CEA ratio with recommendation that "simply by reversing the numerator and denominator (for monetized outcomes) a conventional ROI ratio will be created" p67 [72] runs deeply against the main methodological developments in health economic evaluation that relate to the quantification of uncertainty in decision making.[35] Decisions on incremental cost-effectiveness require estimations of uncertainty, e.g. confidence intervals around incremental cost-effectiveness ratios or measures of net benefit to give an indication of the level of uncertainty. So too, when decisions are based on threshold values, cost-effectiveness acceptability curves are recommended in order to present the probability the intervention is more cost-effective than the alternative.[35,73] This cannot be achieved by reporting simple cost effectiveness ratios. Such ratios have disconcerting measurement and interpretational difficulties.

It is my recommendation that the operationalisation of the VOI framework in WHP should more closely be aligned with standard research-driven principles of health economics.

Ultimately WHP scholars should decide what the best economic form to use is if a prescriptive framework is taken as best practice. There are clear distinctions between cost-effectiveness (cost-utility) and cost-benefit analysis (CBA). A CBA can assess whether a program is worthwhile, without external reference. It can answer questions regarding allocative efficiency, whether to expand the budget to accommodate a new program, which goals are worth achieving, and was it worthwhile.[74] In contrast cost effectiveness analysis (cost-utility analysis) is concerned with marginal gains in consideration of threshold cost-effectiveness values or budget constraint. This form of analysis looks at the additional cost of producing an extra X, Y, Z, and therefore informs questions on production efficiency (for which the conventional outcome is health benefit).

Yet WHP outcomes go beyond health. They have multi-level employee, environment, social, political, and organisational foci. Thus, possibly the more relevant form to take is cost-benefit analysis which is routinely performed in policy reform, economics of safety and physical risk, the environment, behavioural economics, transportation, drugs and alcohol, exhaustible resources, social welfare, justice, infrastructure and of course health.

6.8 Thesis recommendations in summary

- Use terminology and convention that already exist in health economics and commit to a common economic language in economic research.
- To be of high quality, economic evaluations in WHP must report financial outcomes through identification, measurement and valuation of the costs and benefits of the intervention alongside a comparator.
- It is advisable that reporting of economic evaluations follow the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) guidelines.
- Health is a positive, multi-dimensional concept with multiple determinants. Economic evaluations of WHP can better evaluate outcomes by measuring beyond healthy lifestyles and health risks and towards employee wellbeing and quality of life. Health utility is a responsive measure for this purpose.
- Monitoring and evaluation and stakeholder partnership help to support projects that assist sustainable actions in WHP.
- Simple tools to engage business have utility for governments and health promotion advocates and assist in developing the business resource toolbox.
- Continue the academic debate. “Economists are usually accused of three sins: an inability to agree among themselves, stating the obvious and giving bad advice”p1.[75] Conducting economic evaluations in WHP is a complex undertaking and complexities necessitate academic debate. This shouldn’t undermine confidence in the science of health economics in its application to evaluate WHP interventions rather highlight the importance of robust and transparent analysis and the evaluator’s unflinching determination to report and communicate within the current accepted guidelines and standards.

6.9 Research priorities and further work

6.9.1.1 Note 1

It has been demonstrated that another conventional measure of health utility (EQ-5D) only captured health promotion outcomes partially (from the participants’ perspective in a lifestyle behaviour change study[76]). This discovery gives confirmatory evidence that health promotion has unmeasured impacts (benefits) beyond health-related quality of life.

Conceivably beyond what is captured by SF-6D (see Chapter 4). An even broader measurement in the wellbeing domain is missing in public health programs, one that can capture outcomes such as improvements in knowledge, opportunities, skills, accessibility.[76] A promising development possibly helping to address the complexity and breadth of potential impacts arising from health promotion interventions is the exploration of Sen's capability approach.[59,77] This approach is shifting from theoretical suitability to applicability in economic evaluations of public health interventions.[78] It measures capabilities (a person's *ability* to achieve) rather than "functionings" (what they manage to do); for 'functioning' depends on a range of personal and social factors.[59,79] The latest development is the ICECAP-A, a brief self-report 'capability wellbeing measure' for adults. It incorporates five domains: stability, attachment, achievement, autonomy and enjoyment.[80] ICECAP-A has been used in studies in the UK, USA, Australia and New Zealand[81] and most recently has been scored using UK population level weights (tariff) for each of the domains to elicit value anchored between zero [a state of 'no capability'] and one ['full capability']. This tariff enables its use in economic evaluations within health and public policy.[81] In the current WHP community where guidance and criteria are being developed to better measure healthy culture and organisational capacity, these even broader measures of wellbeing may rival health-related quality of life wellbeing measures. Further investigation is a priority for WHP researchers.

6.9.1.2 Note 2

Health is not the only outcome in WHP. Indeed non-health measures of outcome, both quantifiable and non-quantifiable, exist. So as not to ignore them in health economic evaluations, adoption of other valuation methods should be considered, for example, contingent valuation (CV). CV is a stated preference approach eliciting willingness-to-pay (or willingness-to-accept) measures that represent an individual's perceived value for the specified contingency. It offers a method for measuring benefits within CBA studies that can place monetary value on non-market goods.[74] CV has been explored as a potential solution to capture broader benefits in the public health arena.[82,83] Although found to be a feasible method, currently CV is not recommended as the sole valuation method to support decision-making in public health.[83] There is need for further testing within other public health interventions such as WHP. Nevertheless, economic evaluations of WHP can gain greater understandings through investigation into other methodological applications within health economics. This will invariably take a more significant and in-depth account of applied methods of cost-benefit analysis in WHP.

6.9.1.3 Note 3

Comprehensive and thoughtful models already exist in WHP or are being utilised to increase the knowledge in the field, such as the recent HERO-PHA collaboration project and the Precede-proceed model for community health and development. Developing an economic model alongside a best-practice guideline in WHP is an ambitious undertaking but an important next step.

6.10 Thesis Conclusion

Health economics is a framework that helps evaluations in workplace health promotion to be explicit about relevant costs and benefits. It also provides a set of techniques to assist decision making towards effectiveness objectives. To be truly informative, economic evaluations should be comparative analyses accounting for both costs and benefits.

Conducting economic evaluations in WHP is a complex undertaking in a complex system of health promotion and workplace dynamics. Frustratingly, there is still no complete answer as to the best method to improve the science of workplace health promotion. The analyses and works herein are a fractal of the greater research efforts across the globe to better align economic evaluation in WHP with robust standards. The use of health economic theory as a way to guide this pursuit has been discussed. It is my hope that through this work the reader has a sense of the significance that workplace health promotion adds to the fabric of public health, economic development, and population health research. The workplace contains a large 'captive' audience where WHP initiatives that improve employee health can minimise the global burden of chronic disease. It is my sincere hope that the recommendations arising from my work into the microeconomic application of health economics in workplace health promotion will indeed assist the sustainability of WHP.

6.11 References

1. Smith BJ, Tang KC, Nutbeam D. WHO Health Promotion Glossary: new terms. *Health Promot Int.* Dec 2006;21(4):340-345.

2. World Health Organization. Global Health Observatory (GHO) data: World Health Statistics Part II Global health Indicators. Available at http://who.int/gho/publications/world_health_statistics/2015/en/ Accessed June 2015. 2015.

3. Population Reference Bureau. World population Data Sheet. Available at http://www.prb.org/Publications/Datasheets/2012/world-population-data-sheet.aspx. 2012.

4. Loef M, Walach H. The combined effects of healthy lifestyle behaviors on all cause mortality: a systematic review and meta-analysis. *Prev. Med.* 2012;55(3):163-170.

5. Bellew B SGA, King L.,. Workplace screening programs for chronic disease prevention, a rapid review: an Evidence Check brokered by the Sax Institute (www.saxinstitute.org.au) for the NSW Ministry of Health, Australia. 2012.

6. British Government Department of Work and Pensions. *Fuller Working Lives - a framework for action. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/319872/fuller-working-lives.pdf.* UK: Department of Work adn Pensions ISBN: 978-1-78425-184-0;2014.

7. Patient Protection and Affordable Care Act. Subtitle D-Provisions Relating to Title IV. HR 3590 EAS/PP Available at http://www.hhs.gov/healthcare/rights/law/title/iv-amendments.pdf Accessed March 2014. 2010.

8. Gruszin S HD, Glover, J. Advocacy and action in public health: lessons from Australia over the twentieth century. Canberra: Australian National Preventive Health Agency. Available at http://www.adelaide.edu.au/phidu/publications/2010-2014/advocacy-public-health.html. 2012.

9. Parliament of Australia. *Budget papers 2014-15; Health. Commonwealth of Australia; 2014. Available at www.budget.gov.au.* Canberra Australia2014.

10. Eckermann S. Avoiding a health system hernia and the associated outcomes and costs. *Aust. N. Z. J. Public Health.* 2014;38(4):303-305.

11. Shiell A, Hawe P. Health promotion community development and the tyranny of individualism. *Health Econ.* May-Jun 1996;5(3):241-247.

12. Carter R, Vos T, Moodie M, Haby M, Magnus A, Mihalopoulos C. Priority setting in health: origins, description and application of the Australian Assessing Cost-Effectiveness initiative. 2008.

13. Aveling EL, Martin G. Realising the transformative potential of healthcare partnerships: Insights from divergent literatures and contrasting cases in high- and low-income country contexts. *Soc. Sci. Med.* Sep 2013;92:74-82.

14. Shemilt I MM, Vale L, Marsh K, Donaldson C (editors). *Evidence-based decisions*

and economics : health care, social welfare, education and criminal justice. 2nd ed. Chichester, West Sussex, UK ; Hoboken, NJ: Wiley-Blackwell/BMJ Books; 2010.

15. Effective Public Health Practice Project (EPHPP). Available at http://www.ephpp.ca/ourwork.html.
16. Sax Institute. Available at https://www.saxinstitute.org.au.
17. Evidence for Policy and Practice Information (EPPI) and Co-ordinating Centre Available at https://eppi.ioe.ac.uk/cms/.
18. Guide to Community Preventive Services (The Guide). Available at http://www.cdc.gov/epo/communityguide.htm.
19. CRD N. NHS Centre for Reviews and Dissemination. *Undertaking systematic reviews of research on effectiveness.* 2001.
20. Rickles D HP, Shiell A. A simple guide to chaos and complexity. *J. Epidemiol. Community Health.* 2007;61:93-97.
21. Rychetnik L, Frommer M, Hawe P, Shiell A. Criteria for evaluating evidence on public health interventions. *J. Epidemiol. Community Health.* Feb 2002;56(2):119-127.
22. Shiell A, Hawe P, Gold L. Complex interventions or complex systems? Implications for health economic evaluation. *BMJ.* Jun 7 2008;336(7656):1281-1283.
23. World Health Organization. Health Promotion Glossary. *Division of Health Promotion, Education and Communications (HPR), Health Educations and Health Promtoion Unit (HEP) WHO/HPR/HEP/98.1* 1998.
24. Husereau D DM, Petrou S, et al. Consolidated health economic evaluation reporting standards (CHEERS)—Explanation and elaboration: A report of the ISPOR health economic evaluations publication guidelines good reporting practices task force. *Value Health 2013;16:231-50.* 2013.
25. Stevens DE. *Phase II: Developing the Business Case - World Cafe Results. Role of Corporate America in Community Health and Wellness. Available at www.the-hero.org Accessed in* MATRIX Public Health Solutions Inc.;2014.
26. Cleary CM. Hilton MF. Sheridan J. Whiteford HA. Corporate barriers preventing the initiation of mental health programs. *Journal of Occupational Health Safety - Aust NZ* 2008;24(6):507-517.
27. Health Enhancement Research Organization (HERO) and Population Health Alliance (PHA). Program Measurement and Evaluation Guide: Core Metrics for Employee Health Management Available at: http://hero-health.org/wp-content/uploads/2015/02/HERO-PHA-Metrics-Guide-FINAL.pdf Accessed April 2015. 2015.
28. Nutbeam D. Evaluating health promotion—progress, problems and solutions. *Health Promot Int.* 1998;13(1):27.
29. World Health Organization - Regional Office for the Western Pacific. Regional guidelines for the development of healthy workplaces. Available at

http://www.who.int/occupational_health/regions/en/oehwproguidelines.pdf?ua=1 Accessed March 2015. Mania, WHO-WPRO1999.

30. Benach J, Muntaner C, Solar O, Santana V, Quinlan M. Introduction to the WHO Commission on Social Determinants of Health Employment Conditions Network (EMCONET) study, with a glossary on employment relations. *Int. J. Health Serv.* 2010;40(2):195-207.

31. Keller PA, Lehmann DR, Milligan KJ. Effectiveness of Corporate Well-Being Programs A Meta-Analysis. *Journal of Macromarketing.* Sep 2009;29(3):279-302.

32. Green L. and Kreuter M. *Health Promotion Planning: An Educational and Ecological Approach (4th ed.). Chapter 2: Other models for promoting community health and development. Available at http://ctb.ku.edu/en/table-contents/overview/other-models-promoting-community-health-and-development/preceder-proceder/main Accessed June 2015.* Mountain View, Calilfornia, USA: Mayfield Publishers; 2005.

33. Richardson J MJ, Bariola E.,. Review and Critique of Health Related Multi Attribute Utility Instruments In: Culyer A, editor.Encyclopedia of health economics. San Diego: Elsevier Science; in press. Available from: http://www.buseco.monash.edu.au/centres/che/pubs/researchpaper64.pdf. 2011.

34. Williams A. Health Economics: the cheerful face of a dismal science. In: Williams A, ed. *Health and Economics*. London: Macmillan; 1987.

35. Drummond MF, Sculpher MJ, Torrance GW. *Methods for the economic evaluation of health care programmes 3rd edition.* Oxford University Press, USA; 2005.

36. Connor MF, EM. Umland, B. Anderson, D. Alexander, G. Brennan, M. Flynn, J. Grossmeier, J. Hamlin, B. Juster, I. Kaplan, G. Long, A. Nelson, C. Palma-Davis, L. Palmer, R. Srivastava, P. Veroff, D. Noyce, J. Moseley, K. Damsker, M,. The Art of Health Promotion ideas for improving health outcomes Editor's Desk: The Measurement Issue. *Am. J. Health Promot.* 2014;28(4 (TAPH)).

37. Australian Government Department of Health. Pharmaceutical Benefits Advisory Committee (PBAC) Guidelines Available at http://www.pbac.pbs.gov.au/product-type-3/pt3.4-economic-evaluation.html Accessed on 5 May 2015.

38. Goetzel RZ, Tabrizi MJ, Roemer EC, Smith KJ, Kent K. The Art of Health Promotion ideas for improving health outcomes Editor's Desk: Organizational Health Scorecards. 2013.

39. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ.* 2008;337.

40. Mdege ND, Man M-S, Taylor CA, Torgerson DJ. Systematic review of stepped wedge cluster randomized trials shows that design is particularly used to evaluate interventions during routine implementation. *J. Clin. Epidemiol.* 2011;64(9):936-948.

41. Brown CA, Lilford RJ. The stepped wedge trial design: a systematic review. *BMC medical research methodology.* 2006;6(1):54.

42. Medical Research Council. Developing and evaluating complex interventinos: new guidance. Available at http://www.mrc.ac.uk/documents/pdf/complex-interventions-guidance/. 2006.

43. Hoch JS, Briggs AH, Willan AR. Something old, something new, something borrowed, something blue: a framework for the marriage of health econometrics and cost-effectiveness analysis. *Health Econ.* Jul 2002;11(5):415-430.

44. Stinnett AA, Mullahy J. Net health benefits: a new framework for the analysis of uncertainty in cost-effectiveness analysis. *Med. Decis. Making.* Apr-Jun 1998;18(2 Suppl):S68-80.

45. Iglesias CP, Drummond MF, Rovira J. Health-care decision-making processes in Latin America: problems and prospects for the use of economic evaluation. *Int. J. Technol. Assess. Health Care.* Winter 2005;21(1):1-14.

46. Oleckno W. *Essential Epidemiology: Principles and Applications.* Long Grove, Illinois: Waveland press, Inc.; 2002.

47. Chu C, Driscoll T, Dwyer S. The health-promoting workplace: an integrative perspective. *Aust. N. Z. J. Public Health.* 1997;21(4 Spec No):377-385.

48. Newman L, Baum F, Harris E. Federal, State and Territory government responses to health inequities and the social determinants of health in Australia. *Health promotion journal of Australia.* 2006;17(3):217.

49. Cobiac L, Vos T, Veerman L. Cost-effectiveness of Weight Watchers and the Lighten Up to a Healthy Lifestyle program. *Aust. N. Z. J. Public Health.* Jun 2010;34(3):240-247.

50. Cohen P, Darling C, Hampson A, Downs K, Tasset-Tisseau A. Influenza vaccination in an occupational setting: effectiveness and cost-benefit study (Structured abstract). *Journal of Occupational Health and Safety - Australia and New Zealand.* 2003(2):167-182. http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-22003009406/frame.html.

51. Dalziel K, Segal L. Time to give nutrition interventions a higher profile: cost-effectiveness of 10 nutrition interventions. *Health Promot Int.* Dec 2007;22(4):271-283.

52. Eckermann S, Dawber J, Yeatman H, Quinsey K, Morris D. Evaluating return on investment in a school based health promotion and prevention program: the investment multiplier for the Stephanie Alexander Kitchen Garden National Program. *Soc. Sci. Med.* Aug 2014;114:103-112.

53. Forster M, Veerman JL, Barendregt JJ, Vos T. Cost-effectiveness of diet and exercise interventions to reduce overweight and obesity. *Int J Obes (Lond).* Jan 11 2011.

54. Sacks G, Veerman JL, Moodie M, Swinburn B. ‘Traffic-light’nutrition labelling and ‘junk-food’tax: a modelled comparison of cost-effectiveness for obesity prevention. *Int. J. Obes.* 2011;35(7):1001-1009.

55. Graves N, Barnett AG, Halton KA, et al. Cost-effectiveness of a telephone-delivered intervention for physical activity and diet. *PloS one.* 2009;4(9):e7135.

56. Oldenburg B, Sallis JF, Harris D, Owen N. Checklist of Health Promotion Environments at Worksites (CHEW): development and measurement characteristics. *Am. J. Health Promot.* May-Jun 2002;16(5):288-299.

57. Cocker F, Nicholson JM, Graves N, et al. Depression in working adults: comparing the costs and health outcomes of working when ill. 2014.

58. Sanderson K, Cocker F. Presenteeism: Implications and health risks. *Aust. Fam. Physician.* 2013;42(4):172.

59. Lorgelly PKL, K.D. Elisabeth A.L. Fenwick, E.A.L. and Briggs, A.H. Outcome Measurement in Economic Evaluations of Public Health Interventions: a Role for the Capability Approach? *International Journal of Environmental Research and Public Health Monograph.* 2010;7:2274-2289.

60. Sanderson K, Andrews G. The SF-12 in the Australian population: cross-validation of item selection. *Aust. N. Z. J. Public Health.* 2002;26(4):343-345.

61. Hawthorne G, Korn S, Richardson J. Population norms for the AQoL derived from the 2007 Australian National Survey of Mental Health and Wellbeing. *Aust. N. Z. J. Public Health.* Feb 2013;37(1):7-16.

62. Richardson J, Iezzi A, Khan MA, Maxwell A. Cross-national comparison of twelve quality of life instruments. MIC Paper 2. Melbourne: Centre for Health Economics, Monash University. 2012.

63. Butterworth P, Crosier T. The validity of the SF-36 in an Australian National Household Survey: demonstrating the applicability of the Household Income and Labour Dynamics in Australia (HILDA) Survey to examination of health inequalities. *BMC public health.* 2004;4(1):44.

64. Holden L, Scuffham PA, Hilton MF, Muspratt A, Ng SK, Whiteford HA. Patterns of multimorbidity in working Australians. *Popul Health Metr.* 2011;9(1):15.

65. Milat AJ, King L, Bauman AE, Redman S. The concept of scalability: increasing the scale and potential adoption of health promotion interventions into policy and practice. *Health Promot Int.* Sep 2013;28(3):285-298.

66. Norman R, Church J, van den Berg B, Goodall S. Australian health-related quality of life population norms derived from the SF-6D. *Aust. N. Z. J. Public Health.* 2013;37(1):17-23.

67. Rychetnik L, Bauman A, Laws R, et al. Translating research for evidence-based public health: key concepts and future directions. *J. Epidemiol. Community Health.* Dec 2012;66(12):1187-1192.

68. Shiell AH, P. Jan, S.,. *Feature Essay: The Economic Value of Prevention in State of Preventive Health 2013. Available at http://anpha.gov.au/internet/anpha/publishing.nsf/Content/state-of-prev-health-2013 Accessed November 2013.* 2013.

69. Byrnes JM, Goldstein S, Venator B, et al. The impact of population-based disease

management services for selected chronic conditions: the Costs to Australian Private Insurance-Coaching Health (CAPICHe) study protocol. *BMC public health.* 2012;12(1):114.

70. Doran C, Byrnes JM, Cobiac LJ, Vandenberg B, Vos T. Estimated impacts of alternative Australian alcohol taxation structures on consumption, public health and government revenues. *Med. J. Aust.* 2013;199(9):619-622.

71. Allen J, Anderson DR, Baun B, et al. Reflections on developments in health promotion in the past quarter century from founding members of the American Journal of Health Promotion Editorial Board. *Am. J. Health Promot.* 2011;25(4):ei-eviii.

72. Nelson C.F. Veroff D. *Chapter 8: Value on Investment Framework. In Program Measurement and Evaluation Guide: Core Metrics for Employee Health Management. Health Enhancement Research Organization (HERO) and Population Health Alliance (PHA). Available at: http://hero-health.org/wp-content/uploads/2015/02/HERO-PHA-Metrics-Guide-FINAL.pdf Accessed April 2015.* 2015.

73. Weinstein MC, Siegel JE, Gold MR, Kamlet MS, Russell LB. Recommendations of the Panel on Cost-effectiveness in Health and Medicine. *JAMA.* Oct 16 1996;276(15):1253-1258.

74. McIntosh E, Clarke P, Frew E, Louviere J. *Applied methods of cost-benefit analysis in health care.* Vol 4: OUP Oxford; 2010.

75. Wonderling DG, R. and Black, N.,. *Introduction to Health Economics in Understanding Public Health: London School of Hygiene & Tropical Medicine.* Open University Press McGraw-Hill Education; 2005.

76. Goebbels AF, Lakerveld J, Ament AJ, Bot SD, Severens JL. Exploring non-health outcomes of health promotion: the perspective of participants in a lifestyle behaviour change intervention. *Health Policy.* 2012;106(2):177-186.

77. Sen A. *Capability and well-being.* na; 1993.

78. Smith R, Lorgelly P, Al-Janabi H, Venkatapuram S, Coast J. 39 The capability approach: an alternative evaluation paradigm for health economics? Available at https://books.google.com.au/books?hl=en&lr=&id=6uPX9XeS9g4C&oi=fnd&pg=PA415&dq=AL-JANABI+2012+capability+approach&ots=EH1uIb0f3X&sig=Uf5x93J_0pd04bBnZttUJOH5rxo#v=onepage&q&f=false. *The elgar companion to health economics.* 2012:415.

79. Clark DA. The Capability Approach: Its Development, Critiques and Recent Advances. 2005.

80. Al-Janabi H, Flynn TN, Coast J. Development of a self-report measure of capability wellbeing for adults: the ICECAP-A. *Qual. Life Res.* 2012;21(1):167-176.

81. Flynn TN, Huynh E, Peters TJ, et al. Scoring the Icecap-a Capability Instrument. Estimation of a UK General Population Tariff. *Health Econ.* 2015;24(3):258-269.

82. Borghi J, Jan S. Measuring the benefits of health promotion programmes: Application of the contingent valuation method. *Health Policy.* 2008;87(2):235-248.

83. Alayli-Goebbels AF, Exel J, Ament AJ, Vries NK, Bot SD, Severens JL. Consumer willingness to invest money and time for benefits of lifestyle behaviour change: an application of the contingent valuation method. *Health Expectations.* 2014.

7 Bibliography

AL-JANABI, H., FLYNN, T. N. & COAST, J. 2012. Development of a self-report measure of capability wellbeing for adults: the ICECAP-A. *Quality of Life Research,* 21**,** 167-176.

ALAYLI-GOEBBELS, A. F., EXEL, J., AMENT, A. J., VRIES, N. K., BOT, S. D. & SEVERENS, J. L. 2014. Consumer willingness to invest money and time for benefits of lifestyle behaviour change: an application of the contingent valuation method. *Health Expectations*.

ALDANA, S. G. 2001. Financial impact of health promotion programs: a comprehensive review of the literature. *Am J Health Promot,* 15**,** 296-320.

ALDANA, S. G., JACOBSON, B. H., HARRIS, C. J., KELLEY, P. L. & STONE, W. J. 1993. Influence of a mobile worksite health promotion program on health care costs. *Am J Prev Med,* 9**,** 378-83.

ALDANA, S. G., MERRILL, R. M., PRICE, K., HARDY, A. & HAGER, R. 2005. Financial impact of a comprehensive multisite workplace health promotion program. *Prev Med,* 40**,** 131-7.

ALLEN, J. 2008. Wellness Leadership. Burllington, VT: Healthyculture.com Publisher; 2008.

ALLEN, J., ANDERSON, D. R., BAUN, B., BLAIR, S. N., CHAPMAN, L. S., ERIKSEN, M., FIELDING, J., OMENN, G., ORNISH, D. & PELLETIER, K. R. 2011. Reflections on developments in health promotion in the past quarter century from founding members of the American Journal of Health Promotion Editorial Board. *American Journal of Health Promotion,* 25**,** ei-eviii.

ALLEN, R. F. & ALLEN, J. 1987. A sense of community, a shared vision and a positive culture: core enabling factors in successful culture based health promotion. *American Journal of Health Promotion,* 1**,** 40-7.

ALTMAN, D. G. & BLAND, J. M. 1983. Measurement in medicine: the analysis of method comparison studies. *The statistician,* 32**,** 307-317.

AMERICAN HEART ASSOCIATION DIVISION OF PLANNING 1987. Heart at Work: Technical report, extended field studies.

ANDERSON, D. R., SERXNER, S. A. & GOLD, D. B. 2001. Conceptual framework, critical questions, and practical challenges in conducting research on the financial impact of worksite health promotion. *Am J Health Promot,* 15**,** 281-8.

ANDERZÉN, I. & ARNETZ, B. B. 2005. The impact of a prospective survey-based workplace intervention program on employee health, biologic stress markers, and organizational productivity. *Journal of Occupational and Environmental Medicine,* 47**,** 671.

ANZSCO 2006. Australian and New Zealand Standard Classification of Occupations (ANZSCO), First edition, 2006 (ABS Cat. No. 1220.0).

ARROW, K. J. 1963. Uncertainty and the welfare economics of medical care. *The American economic review***,** 941-973.

AT'KOV, O., AZAROV, A., ZHUKOV, D., NICOLOYANNIS, N. & DURAND, L. 2011. Influenza Vaccination in Healthy Working Adults in Russia: Observational Study of Effectiveness and Return on Investment for the Employer. *Applied Health Economics and Health Policy,* 9**,** 89-99.

AUSTRALIAN BUREAU OF STATISTICS Consumer Price index Cat 6401.0 Available at http://www.abs.gov.au/ausstats/abs@.nsf/mf/6401.0 Accessed on April 2015.

AUSTRALIAN BUREAU OF STATISTICS 2006. Year Book Australia (Cat. No. 1310.0). Canberra ACT: ABS.

AUSTRALIAN BUREAU OF STATISTICS 2008a. Population projections – a tool for examining population aging (Cat. No. 1301.1); Year Book Australia. Canberra ACT: ABS.

AUSTRALIAN BUREAU OF STATISTICS 2008b. Population projections, Australia, 2006 to 2101 (Cat. No. 3222.0). Canberra, ACT.

AUSTRALIAN BUREAU OF STATISTICS 2008c. Regional Wage and Salary Earner Statistics (Cat. No. 5673.0.55.003). . Canberra ACT: ABS.

AUSTRALIAN BUREAU OF STATISTICS 2008d. Year Book Australia, Population projections - a tool for examining population ageing (Cat. No. 1301.0). Canberra ACT: ABS.

AUSTRALIAN BUREAU OF STATISTICS 2011. State and Territory Statistical Indicators Cat. No. (1367.0). Canberra ACT: ABS.

AUSTRALIAN BUREAU OF STATISTICS 2012. Counts of Australian Businesses, Including Entries and Exits, June 2007 until June 2011 (Cat. No. 8165.0). Canberra, ACT: ABS.

AUSTRALIAN GOVERNMENT DEPARTMENT OF HEALTH Medical Services Advisory Council (MSAC) Guidelines Available at http://www.msac.gov.au/internet/msac/publishing.nsf/Content/publications-lp-1 Accessed on March 2015.

AUSTRALIAN GOVERNMENT DEPARTMENT OF HEALTH Pharmaceutical Benefits Advisory Committee (PBAC) Guidelines Available at http://www.pbac.pbs.gov.au/product-type-3/pt3.4-economic-evaluation.html Accessed on 5 May 2015.

AUSTRALIAN GOVERNMENT DEPARTMENT OF HEALTH 2009. Australia: the healthiest country by 2020 - National Preventative Health Strategy - Overview, National Preventive Health Taskforce reoprt 2009 Available at http://www.health.gov.au/internet/preventativehealth/publishing.nsf/Content/national-preventative-health-strategy-1lp Accessed on May 2015.

AUSTRALIAN GOVERNMENT DEPARTMENT OF HEALTH AND AGEING; NATIONAL PARTNERSHIP AGREEMENT ON PREVENTIVE HEALTH (NPAPH) http://www.health.gov.au/internet/main/publishing.nsf/Content/phd-prevention-np.

AUSTRALIAN GOVERNMENT DEPARTMENT OF HEALTH AND AGING National Partnership on Preventive Health (NPAPH) statement of commitment available at: http://www.healthyworkers.gov.au/internet/hwi/publishing.nsf/Content/joint-statement-toc.

AUSTRALIAN GOVERNMENT DEPARTMENT OF HEALTH AND AGING 2011. Joint Statement of Commitment: Promoting good heath at work. Canberra, ACT.

AUSTRALIAN GOVERNMENT GEOSCIENCE AUSTRALIA Area of Australia - States and Territories Availabel at http://www.ga.gov.au/scientific-topics/geographic-information/dimensions/area-of-australia-states-and-territories Accessed on 5 May 2015.

AUSTRALIAN GOVERNMENT: DEPARTMENT OF INNOVATION INDUSTRY SCIENCE AND RESEARCH 2011. Key Statistics: Australian Small Businesses. Canberra ACT.

AUSTRALIAN HUMAN RESOURCES INSTITUTE 2008. HR Pulse 2008, 'Love 'em don't lose 'em' – Identifying Retention Strategies that Work http://www.ahri.com.au/MMSdocuments/profdevelopment/research/research_papers/0803_pulse_vol2_no1_love_em_don't_lose_em_web.pdf. Melbourne, VICTORIA.

AUSTRALIAN NATIONAL PREVENTIVE HEALTH AGENCY (ANPHA) 2013. State of Preventive Health 2013. Report to the Australian Government Minister of Health. Canberra; ANPHA.

AVELING, E. L. & MARTIN, G. 2013. Realising the transformative potential of healthcare partnerships: Insights from divergent literatures and contrasting cases in high- and low-income country contexts. *Soc Sci Med,* 92**,** 74-82.

AWOFESO, N. 2004. What's New About the "New Public Health"? *American Journal of Public Health,* 94**,** 705-709.

BABOR, T., HIGGINS-BIDDLE, J., SAUNDERS, J. & MONTEIRO, M. 2001. AUDIT: The Alcohol Use Disorders Identification Test Guidelines for Use in Primary Care: World Health Organization. *Geneva, Switzerland*.

BAICKER, K., CUTLER, D. & SONG, Z. 2010. Workplace wellness programs can generate savings. *Health Aff (Millwood),* 29**,** 304-11.

BAKER, K. M., GOETZEL, R. Z., PEI, X., WEISS, A. J., BOWEN, J., TABRIZI, M. J., NELSON, C. F., METZ, R. D., PELLETIER, K. R. & THOMPSON, E. 2008. Using a return-on-investment estimation model to evaluate outcomes from an obesity management worksite health promotion program. *J Occup Environ Med,* 50**,** 981-90.

BARTON, G. R., SACH, T. H., AVERY, A. J., JENKINSON, C., DOHERTY, M., WHYNES, D. K. & MUIR, K. R. 2008. A comparison of the performance of the EQ-5D and SF-6D for individuals aged >or= 45 years. *Health Econ,* 17**,** 815-32.

BAUN, W. B., BERNACKI, E. J. & TSAI, S. P. 1986. A preliminary investigation: effect of a corporate fitness program on absenteeism and health care cost. *J Occup Med,* 28**,** 18-22.

BAXTER, S., SANDERSON, K., VENN, A. J., BLIZZARD, C. L. & PALMER, A. J. 2014. The relationship between return on investment and quality of study methodology in workplace health promotion programs. *American Journal of Health Promotion,* 28**,** 347-363.

BAXTER, S. S., K VENN, A OTAHAL, P AND PALMER, AJ; 2015. Construct validity of SF-6D health state utility values in an employed population. *Quality of Life Research,* 24**,** 851-870.

BAZELEY, P. & KEMP, L. 2012. Mosaics, triangles, and DNA metaphors for integrated analysis in mixed methods research. *Journal of Mixed Methods Research,* 6**,** 55-72.

BELLEW, B. 2008. Primary prevention of chronic disease in Australia through interventions in the workplace setting: a rapid review. *Sax Institute for the Chronic Disease Prevention Unit, Victorian Government Department of Human Services*.

BELLEW B, S. G. A., KING L., 2012. Workplace screening programs for chronic disease prevention, a rapid review: an Evidence Check brokered by the Sax Institute (www.saxinstitute.org.au) for the NSW Ministry of Health, Australia.

BENACH, J., MUNTANER, C., SOLAR, O., SANTANA, V. & QUINLAN, M. 2010. Introduction to the WHO Commission on Social Determinants of Health Employment Conditions Network (EMCONET) study, with a glossary on employment relations. *Int J Health Serv,* 40**,** 195-207.

BERTERA, R. L. 1990. The effects of workplace health promotion on absenteeism and employment costs in a large industrial population. *Am J Public Health,* 80**,** 1101-5.

BERTERA, R. L. 1993. Behavioral risk factor and illness day changes with workplace health promotion: two-year results. *Am J Health Promot,* 7**,** 365-73.

BERTERA, R. L., OEHL, L. K. & TELEPCHAK, J. M. 1990. Self-help versus group approaches to smoking cessation in the workplace: Eighteen-month follow-up and cost analysis. *American Journal of Health Promotion,* 4**,** 187-192.

BETTER WORK TASMANIA Workplace health and savings calculator Available at http://www.betterwork.tas.gov.au/membership_benefits_-_public_promotional_information/workplace_health_and_savings_calculator Accessed on 19 March, 2015.

BLACK, C. M. & GREAT BRITAIN. HEALTH WORK WELLBEING. 2008. *Working for a healthier tomorrow : Dame Carol Black's review of the health of britain's working age population : presented to the Secretary of State for Health and the Secretary of State for Work and Pensions; available at http://www.dwp.gov.uk/docs/hwwb-working-for-a-healthier-tomorrow.pdf* [Online]. London: TSO.

BLAIR, S. N., SMITH, M., COLLINGWOOD, T. R., REYNOLDS, R., PRENTICE, M. C. & STERLING, C. L. 1986. Health promotion for educators: impact on absenteeism. *Prev Med,* 15**,** 166-75.

BLY, J. L., JONES, R. C. & RICHARDSON, J. E. 1986. Impact of worksite health promotion on health care costs and utilization. Evaluation of Johnson & Johnson's Live for Life program. *JAMA,* 256**,** 3235-40.

BORGHI, J. & JAN, S. 2008. Measuring the benefits of health promotion programmes: Application of the contingent valuation method. *Health Policy,* 87**,** 235-248.

BOWNE, D. W., RUSSELL, M. L., MORGAN, J. L., OPTENBERG, S. A. & CLARKE, A. E. 1984. Reduced disability and health care costs in an industrial fitness program. *Journal of Occupational and Environmental Medicine,* 26**,** 809.

BRAZIER, J., ROBERTS, J. & DEVERILL, M. 2002. The estimation of a preference-based measure of health from the SF-36. *J Health Econ,* 21**,** 271-92.

BRAZIER, J., ROBERTS, J., TSUCHIYA, A. & BUSSCHBACH, J. 2004. A comparison of the EQ-5D and SF-6D across seven patient groups. *Health economics,* 13**,** 873-884.

BRAZIER, J. E. & ROBERTS, J. 2004. The estimation of a preference-based measure of health from the SF-12. *Medical care,* 42**,** 851-859.

BRIDGES, C. B., THOMPSON, W. W., MELTZER, M. I., REEVE, G. R., TALAMONTI, W. J., COX, N. J., LILAC, H. A., HALL, H., KLIMOV, A. & FUKUDA, K. 2000. Effectiveness and cost-benefit of influenza vaccination of healthy working adults. *JAMA: the journal of the American Medical Association,* 284**,** 1655-1663.

BRIGGS, A. H., O'BRIEN, B. J. & BLACKHOUSE, G. 2002. Thinking outside the box: recent advances in the analysis and presentation of uncertainty in cost-effectiveness studies. *Annual Review of Public Health,* 23**,** 377-401.

BRITISH GOVERNMENT DEPARTMENT FOR WORK AND PENSIONS 2007. Welfare reform http://webarchive.nationalarchives.gov.uk/20130128102031/http://www.dwp.gov.uk/welfarereform/c4.asp

BRITISH GOVERNMENT DEPARTMENT OF WORK AND PENSIONS. 2013. *Workplace Well-being Tool, http://www.dwp.gov.uk/health-work-and-well-being/our-work/workplace-well-being-tool/ Published July 8,2013* [Online].

BRITISH GOVERNMENT DEPARTMENT OF WORK AND PENSIONS 2014. Fuller Working Lives - a framework for action. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/319872/fuller-working-lives.pdf. UK: Department of Work adn Pensions ISBN: 978-1-78425-184-0.

BRITISH GOVERNMENT: DEPARTMENT FOR BUSINESS INNOVATION AND SKILLS 2009. Annual Small Business Survey 2007/08. *In:* WILLIAMS, M. C., M. FOR THE DEPARTMENT OF BUSINESS ENTERPRISE AND REGULATORY REFORM (ed.).

BROOKS, A., HAGEN, S. E., SATHYANARAYANAN, S., SCHULTZ, A. B. & EDINGTON, D. W. 2010. Presenteeism: Critical Issues. *Journal of Occupational and Environmental Medicine,* 52**,** 1055-1067.

BROWN, C. A. & LILFORD, R. J. 2006. The stepped wedge trial design: a systematic review. *BMC medical research methodology,* 6**,** 54.

BRUGGE, D. 2006. Community research in environmental health: studies in science, advocacy and ethics. *Guest Editors,* 17**,** 268.

BUCK CONSULTANTS LLP sixth edition, July 2014. Working Well: A Global Survey of Health Promotion,Workplace Wellness and Productivity Strategies, .

BUDDEBERG-FISCHER, B., KLAGHOFER, R., STAMM, M., SIEGRIST, J. & BUDDEBERG, C. 2008. Work stress and reduced health in young physicians: prospective evidence from Swiss residents. *Int Arch Occup Environ Health,* 82**,** 31-8.

BUNTING, B. A. & CRANOR, C. W. 2006. The Asheville Project: long-term clinical, humanistic, and economic outcomes of a community-based medication therapy management program for asthma (Provisional abstract). *Journal of the American Pharmacists Association* [Online]. Available: http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-22007000163/frame.html.

BUREAU OF LABOR STATISTICS 2009. Employer Costs for Employer Compensation Summary. Washington DC: Bureau of Labor Statistics.

BURTON, W. N., CHEN, C. Y., CONTI, D. J., SCHULTZ, A. B., PRANSKY, G. & EDINGTON, D. W. 2005. The association of health risks with on-the-job productivity. *Journal of Occupational and Environmental Medicine,* 47**,** 769-77.

BUTTERWORTH, P. & CROSIER, T. 2004. The validity of the SF-36 in an Australian National Household Survey: demonstrating the applicability of the Household Income and Labour Dynamics in Australia (HILDA) Survey to examination of health inequalities. *BMC Public Health,* 4**,** 44.

BYRNES, J. M., GOLDSTEIN, S., VENATOR, B., POLLICINO, C., NG, S.-K., VEROFF, D., BENNETT, C. & SCUFFHAM, P. A. 2012. The impact of population-based disease management services for selected chronic conditions: the Costs to Australian Private Insurance-Coaching Health (CAPICHe) study protocol. *BMC public health,* 12**,** 114.

CADY JR, L. D., THOMAS, P. C. & KARWASKY, R. J. 1985. Program for increasing health and physical fitness of fire fighters. *Journal of Occupational and Environmental Medicine,* 27**,** 110.

CAMPBELL AND COCHRANE ECONOMICS METHODS GROUP. *Campbell and Cochrane Economics Methods Group, How to add Health Economics to Cochrane Protocols Available from http://www.c-cemg.org/ [Accessed October 10, 2011]* [Online].

CAMPBELL AND COCHRANE ECONOMICS METHODS GROUP Cochrane Handbook; Chapter 15: Incorporating economics evidence, 15.5.2 Critical appraisal of methodological quality in http://www.cochrane-handbook.org Assessed on 10 October, 2011.

CAMPBELL, D. S. & RUMLEY, M. H. 1997. Cost-effectiveness of the influenza vaccine in a healthy, working-age population. *Journal of Occupational and Environmental Medicine,* 39**,** 408-414.

CANCELLIERE, C., CASSIDY, J. D., AMMENDOLIA, C. & COTE, P. 2011. Are workplace health promotion programs effective at improving presenteeism in workers? A systematic review and best evidence synthesis of the literature. *BMC Public Health,* 11**,** 395.

CARTER, R., VOS, T., MOODIE, M., HABY, M., MAGNUS, A. & MIHALOPOULOS, C. 2008. Priority setting in health: origins, description and application of the Australian Assessing Cost-Effectiveness initiative.

CASS, P., WEISEL, L., MØLLER, T. & NISSÉN, M. The art of collaborative leadership: Through the art of hosting & harvesting conversations that matter. Workbook for University of Tasmania workshops, August, 2011.

CENTRE FOR DISEASE CONTROL AND PREVENTION 2012. The CDC Worksite Health ScoreCare: An Assessment Tool for Employers to Prevent Heart Disease, Stroke, and Related Health Condtions. Atlanta: U.S. Department of Health and Human Services. Available at: http://www.cdc.gov/dhdsp/pubs/worksite_scorecard.htm. Accessed April 3, 2015.

CENTRE FOR REVIEWS AND DISSEMINATION 2009. Systematic Reviews: CRD's guidance for undertaking reviews in health care, 3rd edn.Available at http://www.york.ac.uk/inst/crd/index_guidance.htm Accessed August 4, 2011. York: Centre for Reviews and Dissemination.

CHAPMAN, L. S. 2005. Meta-evaluation of worksite health promotion economic return studies: 2005 update. *Am J Health Promot,* 19**,** 1-11.

CHAPMAN, L. S. 2012. Meta-evaluation of worksite health promotion economic return studies: 2012 update. *Am J Health Promot,* 26**,** TAHP1-TAHP12.

CHENOWETH, D. H. & GARRETT, J. 2006. Cost-effectiveness analysis of a worksite clinic: is it worth the cost? *AAOHN journal : official journal of the American Association of Occupational Health Nurses,* 54**,** 84-89; quiz 90-91.

CHIOU, C. F., HAY, J. W., WALLACE, J. F., BLOOM, B. S., NEUMANN, P. J., SULLIVAN, S. D., YU, H. T., KEELER, E. B., HENNING, J. M. & OFMAN, J. J. 2003. Development and validation of a grading system for the quality of cost-effectiveness studies. *Med Care,* 41**,** 32-44.

CHU, C., BREUCKER, G., HARRIS, N., STITZEL, A., GAN, X., GU, X. & DWYER, S. 2000. Health-promoting workplaces—international settings development. *Health promotion international,* 15**,** 155.

CHU, C., DRISCOLL, T. & DWYER, S. 1997. The health-promoting workplace: an integrative perspective. *Aust N Z J Public Health,* 21**,** 377-85.

CHUNG, M., MELNYK, P., BLUE, D., RENAUD, D. & BRETON, M. C. 2009. Worksite health promotion: The value of the tune Up your heart program. *Population Health Management,* 12**,** 297-304.

CLARK, D. A. 2005. The Capability Approach: Its Development, Critiques and Recent Advances.

CLARKE, P. Edgar Sydenstricker: The first health economist? International Health Economics Association 9th World Congress on Health Economics: Celebrating Health Economics, 7-10 July 2013 Sydney, Australia.

CLEARY CM. HILTON MF. SHERIDAN J. WHITEFORD HA. 2008. Corporate barriers preventing the initiation of mental health programs. *Journal of Occupational Health Safety - Aust NZ* 24**,** 507-17.

COBIAC, L., VOS, T. & VEERMAN, L. 2010. Cost-effectiveness of Weight Watchers and the Lighten Up to a Healthy Lifestyle program. *Aust N Z J Public Health,* 34**,** 240-7.

COCKER, F., NICHOLSON, J. M., GRAVES, N., OLDENBURG, B., PALMER, A. J., MARTIN, A., SCOTT, J., VENN, A. & SANDERSON, K. 2014. Depression in working adults: comparing the costs and health outcomes of working when ill.

COHEN, P., DARLING, C., HAMPSON, A., DOWNS, K. & TASSET-TISSEAU, A. 2003. Influenza vaccination in an occupational setting: effectiveness and cost-benefit study (Structured abstract). *Journal of Occupational Health and Safety - Australia and New Zealand* [Online]. Available: http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-22003009406/frame.html.

COLOMBO, G. L., FERRO, A., VINCI, M., ZORDAN, M. & SERRA, G. 2006. Cost-benefit analysis of influenza vaccination in a public healthcare unit. *Therapeutics and Clinical Risk Management,* 2**,** 219-226.

CONNOR, M. F., EM. UMLAND, B. ANDERSON, D. ALEXANDER, G. BRENNAN, M. FLYNN, J. GROSSMEIER, J. HAMLIN, B. JUSTER, I. KAPLAN, G. LONG, A. NELSON, C. PALMA-DAVIS, L. PALMER, R. SRIVASTAVA, P. VEROFF, D. NOYCE, J. MOSELEY, K. DAMSKER, M, 2014. The Art of Health Promotion ideas for improving health outcomes Editor's Desk: The Measurement Issue. *American Journal of Health Promotion* 28.

CONRAD, K. M., RIEDEL, J. & GIBBS, J. 1990. Effect of worksite health promotion programs on employee absenteeism. A comparative analysis. *AAOHN journal: official journal of the American Association of Occupational Health Nurses,* 38**,** 573.

COOK, E. L. & HARMAN, J. S. 2008. A comparison of health-related quality of life for individuals with mental health disorders and common chronic medical conditions. *Public Health Reports,* 123**,** 45-51.

CRAIG, C. L., MARSHALL, A. L., SJOSTROM, M., BAUMAN, A. E., BOOTH, M. L., AINSWORTH, B. E., PRATT, M., EKELUND, U., YNGVE, A., SALLIS, J. F. & OJA, P. 2003. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc,* 35**,** 1381-95.

CRAIG, P., DIEPPE, P., MACINTYRE, S., MICHIE, S., NAZARETH, I. & PETTICREW, M. 2008. Developing and evaluating complex interventions: the new Medical Research Council guidance. *Bmj,* 337.

CRD, N. 2001. NHS Centre for Reviews and Dissemination. *Undertaking systematic reviews of research on effectiveness*.

CRESWELL, J. W., KLASSEN, A. C., PLANO CLARK, V. L. & SMITH, K. C. 2011. Best practices for mixed methods research in the health sciences. *Bethesda (Maryland): National Institutes of Health***,** 2094-2103.

DALTON, B. A. & HARRIS, J. S. 1991. A comprehensive approach to corporate health management. *Journal of Occupational and Environmental Medicine,* 33**,** 338.

DALZIEL, K. & SEGAL, L. 2007. Time to give nutrition interventions a higher profile: cost-effectiveness of 10 nutrition interventions. *Health Promot Int,* 22**,** 271-83.

DATABASE OF ABSTRACTS OF REVIEWS OF EFFECTS available http://www.crd.york.ac.uk/crdweb/ (accessed October 2011).

DAVIS, L., LOYO, K., GLOWKA, A., SCHWERTFEGER, R., DANIELSON, L., BREA, C., EASTON, A. & GRIFFIN-BLAKE, S. 2009. A comprehensive worksite wellness program in Austin, Texas: partnership between Steps to a Healthier Austin and Capital Metropolitan Transportation Authority. *Preventing chronic disease,* 6**,** A60.

DE GREEF, M. V. D. B., K., 2004. Healthy Employees in Healthy Organisations: Making the case for workplace health promotion - Report. Avaialble at http://www.enwhp.org/good-whp-practice/about-whp/the-case-for-whp.html. Germany: European Network for Workplace Health Promotion,.

DE JONGE, J., BOSMA, H., PETER, R. & SIEGRIST, J. 2000. Job strain, effort-reward imbalance and employee well-being: a large-scale cross-sectional study. *Social Science & Medicine,* 50**,** 1317-1327.

DE SALAZAR, L., JACKSON, S., SHIELL, A. & RICE, M. 2007. Guide to economic evaluation in health promotion. *Washington: Pan American Health Organization*.

DEITZ, D., COOK, R. & HERSCH, R. 2005. Workplace health promotion and utilization of health services: Follow-up data findings. *Journal of Behavioral Health Services and Research,* 32**,** 306-319.

DEJOY, D. M., WILSON, M. G., GOETZEL, R. Z., OZMINKOWSKI, R. J., WANG, S., BAKER, K. M., BOWEN, H. M. & TULLY, K. J. 2008. Development of the Environmental Assessment Tool (EAT) to measure organizational physical and social support for worksite obesity prevention programs. *Journal of occupational and environmental medicine/American College of Occupational and Environmental Medicine,* 50**,** 126.

DEPARTMENT OF BUSINESS INNOVATION AND SKILLS 2010. Small and Medium-sized Enterprise (SME) Statistics for the UK and Regions 2009. London, UK: Government of the United Kingdom.

DEPARTMENT OF HEALTH AND HUMAN SERVICES, T. S. G. Healthy Workplace Resource Toolkit, available at www.tas.gov.au.

DEPARTMENT OF HEALTH_UK 2011. The NHS Health and Well Being Improvement framework, Department of Health: 2011 http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_128813.pdf.

DILLE, J. H. 1999. A worksite influenza immunization program: Impact on lost work days, health care utilization, and health care spending. *AAOHN Journal,* 47**,** 301-309.

DIVINE, R. 2005. Determinants of Small Business Interest in Offering a Wellness Program to Their Employees. *Health Marketing Quarterly,* 22**,** 43-58.

DORAN, C., BYRNES, J. M., COBIAC, L. J., VANDENBERG, B. & VOS, T. 2013. Estimated impacts of alternative Australian alcohol taxation structures on consumption, public health and government revenues. *Med J Aust,* 199**,** 619-622.

DOWNEY, A. M. & SHARP, D. J. 2007. Why do managers allocate resources to workplace health promotion programmes in countries with national health coverage? *Health Promotion International,* 22**,** 102-111.

DRUMMOND, M. F. & JEFFERSON, T. O. 1996. Guidelines for authors and peer reviewers of economic submissions to the BMJ. The BMJ Economic Evaluation Working Party. *BMJ,* 313**,** 275-83.

DRUMMOND, M. F., SCULPHER, M. J. & TORRANCE, G. W. 2005. *Methods for the economic evaluation of health care programmes 3rd edition*, Oxford University Press, USA.

ECKERMANN, S. 2014. Avoiding a health system hernia and the associated outcomes and costs. *Australian and New Zealand journal of public health,* 38**,** 303-305.

ECKERMANN, S., DAWBER, J., YEATMAN, H., QUINSEY, K. & MORRIS, D. 2014. Evaluating return on investment in a school based health promotion and prevention program: the investment multiplier for the Stephanie Alexander Kitchen Garden National Program. *Social Science and Medicine,* 114**,** 103-12.

EDINGTON, D. W., YEN, L. T. & WITTING, P. 1997. The financial impact of changes in personal health practices. *Journal of Occupational and Environmental Medicine,* 39**,** 1037-1046.

EFFECTIVE PUBLIC HEALTH PRACTICE PROJECT (EPHPP) Available at http://www.ephpp.ca/ourwork.html.

ERIKSSON, C. 2000. Learning and knowledge-production for public health: a review of approaches to evidence-based public health. *Scand J Public Health,* 28**,** 298-308.

EUROPEAN NETWORK FOR WORKPLACE HEALTH PROMOTION Luxembourg Declaration on Workplace Health Promotion in the European Union, adopted on November 27-28, 1997 and updated in June 2005 and January 2007. Available at http://www.enwhp.org/fileadmin/rs-dokumente/dateien/Luxembourg_Declaration.pdf Accessed on 16 April, 2015.

EVERS, S., GOOSSENS, M., DE VET, H., VAN TULDER, M. & AMENT, A. 2005. Criteria list for assessment of methodological quality of economic evaluations: Consensus on Health Economic Criteria. *Int J Technol Assess Health Care,* 21**,** 240-5.

EVIDENCE FOR POLICY AND PRACTICE INFORMATION (EPPI) AND CO-ORDINATING CENTRE Available at https://eppi.ioe.ac.uk/cms/.

FARAGHER, E. B., CASS, M. & COOPER, C. L. 2005. The relationship between job satisfaction and health: a meta-analysis. *Occup Environ Med,* 62**,** 105-12.

FINKELSTEIN, E. A., LINNAN, L. A., TATE, D. F. & LEESE, P. J. 2009. A longitudinal study on the relationship between weight loss, medical expenditures, and absenteeism among overweight employees in the WAY to Health study. *J Occup Environ Med,* 51**,** 1367-73.

FLYNN, T. N., HUYNH, E., PETERS, T. J., AL-JANABI, H., CLEMENS, S., MOODY, A. & COAST, J. 2015. Scoring the Icecap-a Capability Instrument. Estimation of a UK General Population Tariff. *Health economics,* 24**,** 258-269.

FONAROW, G. C., CALITZ, C., ARENA, R., BAASE, C., ISAAC, F. W., LLOYD-JONES, D., PETERSON, E. D., PRONK, N., SANCHEZ, E. & TERRY, P. E. 2015. Workplace Wellness Recognition for Optimizing Workplace Health A Presidential Advisory From the American Heart Association. *Circulation,* 131**,** e480-e497.

FOOTE, A. & ERFURT, J. C. 1991. The benefit to cost ratio of work-site blood pressure control programs. *JAMA: the journal of the American Medical Association,* 265**,** 1283-1286.

FORSTER, M., VEERMAN, J. L., BARENDREGT, J. J. & VOS, T. 2011. Cost-effectiveness of diet and exercise interventions to reduce overweight and obesity. *Int J Obes (Lond)*.

FRANKS, P., HANMER, J. & FRYBACK, D. G. 2006. Relative disutilities of 47 risk factors and conditions assessed with seven preference-based health status measures in a national U.S. sample: toward consistency in cost-effectiveness analyses. *Med Care,* 44**,** 478-85.

FRYBACK, D. G., DUNHAM, N. C., PALTA, M., HANMER, J., BUECHNER, J., CHEREPANOV, D., HERRINGTON, S. A., HAYS, R. D., KAPLAN, R. M., GANIATS, T. G., FEENY, D. & KIND, P. 2007. US norms for six generic health-related quality-of-life indexes from the National Health Measurement study. *Medical Care,* 45**,** 1162-70.

GETTMAN, L. 1986. Cost/benefit analysis of a corporate fitness program. *Fitness in Business,* 1**,** 11-17.

GETZEN, T. 2013. Sir William Petty: The First Health Economics by Number, Weight and Measure. *International Health Economics Association 9th World Congress on Health Economics: Celebrating Health Economics.* Sydney, Australia.

GIBBS, J. O., MULVANEY, D., HENES, C. & REED, R. W. 1985. Work-site health promotion. Five-year trend in employee health care costs. *J Occup Med,* 27**,** 826-30.

GOEBBELS, A. F., LAKERVELD, J., AMENT, A. J., BOT, S. D. & SEVERENS, J. L. 2012. Exploring non-health outcomes of health promotion: the perspective of participants in a lifestyle behaviour change intervention. *Health Policy,* 106**,** 177-186.

GOETZEL R. Financial Impact of Workplace Health Promotion: 2015 Update. 25th Annual Art and Science of Health Promotion Conference, San Diego, California, April 2. , 2015.

GOETZEL R. 2015. Don't Throw Out the Baby with the Bathwater - A Measured Response to Critics of Workplace Health Promotion and Disease Prevention Programs. Health Enhancement Research Organization (HERO) Webinar, April 22. Available at http://hero-health.org/events/ Accessed on May

GOETZEL, R. Z., DUNN, R. L., OZMINKOWSKI, R. J., SATIN, K., WHITEHEAD, D. & CAHILL, K. 1998a. Differences between descriptive and multivariate estimates of the impact of Chevron Corporation's Health Quest program on medical expenditures. *Journal of Occupational and Environmental Medicine,* 40**,** 538.

GOETZEL, R. Z., JACOBSON, B. H., ALDANA, S. G., VARDELL, K. & YEE, L. 1998b. Health care costs of worksite health promotion participants and non-participants. *Journal of Occupational and Environmental Medicine,* 40**,** 341.

GOETZEL, R. Z., JUDAY, T. R. & OZMINKOWSKI, R. J. 1999. What’s the ROI. *A systematic review of return on investment (ROI) studies of corporate health and productivity management initiatives. AWHP's Worksite Health***,** 12-21.

GOETZEL, R. Z., LONG, S. R., OZMINKOWSKI, R. J., HAWKINS, K., WANG, S. & LYNCH, W. 2004. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. *Journal of Occupational and Environmental Medicine,* 46**,** 398-412.

GOETZEL, R. Z., OZMINKOWSKI, R. J., BAASE, C. M. & BILLOTTI, G. M. 2005. Estimating the return-on-investment from changes in employee health risks on the Dow Chemical Company's health care costs. *J Occup Environ Med,* 47**,** 759-68.

GOETZEL, R. Z., PEI, X., TABRIZI, M. J., HENKE, R. M., KOWLESSAR, N., NELSON, C. F. & METZ, R. D. 2012. Ten modifiable health risk factors are linked to more than one-fifth of employer-employee health care spending. *Health Aff (Millwood),* 31**,** 2474-84.

GOETZEL, R. Z., TABRIZI, M. J., ROEMER, E. C., SMITH, K. J. & KENT, K. 2013. The Art of Health Promotion ideas for improving health outcomes Editor's Desk: Organizational Health Scorecards.

GOLASZEWSKI, T., BARR, D. & PRONK, N. 2003. Development of assessment tools to measure organizational support for employee health. *American Journal of Health Behavior,* 27**,** 43-54.

GOLASZEWSKI, T., SNOW, D., LYNCH, W., YEN, L. & SOLOMITA, D. 1992. A benefit-to-cost analysis of a work-site health promotion program. *J Occup Med,* 34**,** 1164-72.

GRAVES, N., BARNETT, A. G., HALTON, K. A., VEERMAN, J. L., WINKLER, E., OWEN, N., REEVES, M. M., MARSHALL, A. & EAKIN, E. 2009. Cost-effectiveness of a telephone-delivered intervention for physical activity and diet. *PloS one,* 4**,** e7135.

GREEN L. AND KREUTER M. 2005. *Health Promotion Planning: An Educational and Ecological Approach (4th ed.). Chapter 2: Other models for promoting community health and development. Available at http://ctb.ku.edu/en/table-contents/overview/other-models-promoting-community-health-and-development/preceder-proceder/main Accessed June 2015,* Mountain View, Calilfornia, USA, Mayfield Publishers.

GREENE, B. L., MILLER, J. D., BROWN, T. M., HARSHMAN, R. S., RICHERSON, G. T. & DOYLE, J. J. 2009. Economic impact of the BP DownShift Program on blood pressure control among commercial driver license employees. *J Occup Environ Med,* 51**,** 542-53.

GRIFFITH UNIVERSITY CENTRE FOR POPULATION AND ENVIRONMENTAL HEALTH 2010. HealthyWork Professional Development Course Guide.

GROENEVELD, I. F., VAN WIER, M. F., PROPER, K. I., BOSMANS, J. E., VAN MECHELEN, W. & VAN DER BEEK, A. J. 2011. Cost-effectiveness and cost-benefit of a lifestyle intervention for workers in the construction industry at risk for cardiovascular disease. *Journal of Occupational and Environmental Medicine,* 53**,** 610.

GROSSMEIER, J., TERRY, P. E., CIPRIOTTI, A. & BURTAINE, J. E. 2010. Best practices in evaluating worksite health promotion programs. *Am J Health Promot,* 24**,** TAHP1-9, iii.

GRUSZIN S, H. D., GLOVER, J 2012. Advocacy and action in public health: lessons from Australia over the twentieth century. Canberra: Australian National Preventive Health Agency. Available at http://www.adelaide.edu.au/phidu/publications/2010-2014/advocacy-public-health.html.

GUIDE TO COMMUNITY PREVENTIVE SERVICES (THE GUIDE) Available at http://www.cdc.gov/epo/communityguide.htm.

HAGSTROMER, M., OJA, P. & SJOSTROM, M. 2006. The International Physical Activity Questionnaire (IPAQ): a study of concurrent and construct validity. *Public Health Nutr,* 9**,** 755-62.

HALL-BARROW, J., HODGES, L. & BROWN, P. 2001. A collaborative model for employee health and nursing education. Successful program. *AAOHN journal: official journal of the American Association of Occupational Health Nurses,* 49**,** 429.

HAMBERG-VAN REENEN, H. H., PROPER, K. I. & VAN DEN BERG, M. 2012. Worksite mental health interventions: a systematic review of economic evaluations. *Occup Environ Med,* 69**,** 837-845.

HANEBUTH, D., MEINEL, M. & FISCHER, J. E. 2006. Health-related quality of life, psychosocial work conditions, and absenteeism in an industrial sample of blue- and white-collar employees: a comparison of potential predictors. *J Occup Environ Med,* 48**,** 28-37.

HARRIS, J. S. 1986. Northern Telecom: A million dollar medically based program in a rapidly changing high tech environment. *American journal of health promotion,* 1**,** 50-84.

HARVEY, M. R., WHITMER, R. W., HILYER, J. C. & BROWN, K. C. 1993. The impact of a comprehensive medical benefit cost management program for the city of Birmingham: results at five years. *American journal of health promotion,* 7**,** 296-303.

HAWTHORNE, G., KORN, S. & RICHARDSON, J. 2013. Population norms for the AQoL derived from the 2007 Australian National Survey of Mental Health and Wellbeing. *Aust N Z J Public Health,* 37**,** 7-16.

HEALTH AT WORK NETWORK OF THE PUBLIC HEALTH RESPONSIBILITY DEAL http://www.dh.gov.uk/en/Publichealth/Publichealthresponsibilitydeal/index.htm

HEALTH ENHANCEMENT RESEARCH ORGANIZATION (HERO) AND POPULATION HEALTH ALLIANCE (PHA) 2015. Program Measurement and Evaluation Guide: Core Metrics for Employee Health Management Available at: http://hero-health.org/wp-content/uploads/2015/02/HERO-PHA-Metrics-Guide-FINAL.pdf Accessed April 2015.

HEALTH PROMOTION BOARD, S. G. Essential Guide to Workplace Health Promotion. Available at https://www.hpb.gov.sg/HOPPortal/health-article/HPBSUEXTAPP1_4021894 Accessed 10 April 2015.

HEALTHIER WORKPLACE WA Workplace Health Savings Calculator available at http://healthierworkplacewa.com.au/learn/workplace-health-savings-calculator/ Accessed on 119 March, 2015.

HEMINGWAY, H., NICHOLSON, A., STAFFORD, M., ROBERTS, R. & MARMOT, M. 1997. The impact of socioeconomic status on health functioning as assessed by the SF-36 questionnaire: the Whitehall II Study. *Am J Public Health,* 87**,** 1484-90.

HENKE, R. M., GOETZEL, R. Z., MCHUGH, J. & ISAAC, F. 2011. Recent experience in health promotion at Johnson & Johnson: Lower health spending, strong return on investment. *Health Affairs,* 30**,** 490-499.

HENRITZE, J., BRAMMELL, H. L. & MCGLOIN, J. 1992. LIFECHECK: A successful, low touch, low tech, in-plant, cardiovascular disease risk identification and modification program. *American Journal of Health Promotion,* 7**,** 129-136.

HERO BEST PRACTICE SCORECARD IN COLLABORATION WITH MERCER, V. Available at: http://www.the-hero.org/scorecard_folder/scorecard.htm Accessed April 3, 2015.

HOCH, J. S., BRIGGS, A. H. & WILLAN, A. R. 2002. Something old, something new, something borrowed, something blue: a framework for the marriage of health econometrics and cost-effectiveness analysis. *Health Economics,* 11**,** 415-30.

HOCH, J. S. & DEWA, C. S. 2014. Advantages of the net benefit regression framework for economic evaluations of interventions in the workplace: a case study of the cost-effectiveness of a collaborative mental health care program for people receiving short-term disability benefits for psychiatric disorders. *Journal of Occupational and Environmental Medicine,* 56**,** 441-5.

HODGES, L. C., HARPER, T. S., HALL-BARROW, J. & TATOM, I. D. 2004. Reducing overall health care costs for a city municipality: a real life community based learning model. *AAOHN journal: official journal of the American Association of Occupational Health Nurses,* 52**,** 247.

HOFLER, M., PFISTER, H., LIEB, R. & WITTCHEN, H. U. 2005. The use of weights to account for non-response and drop-out. *Social Psychiatry and Psychiatric Epidemiology,* 40**,** 291-9.

HOLDEN, L., SCUFFHAM, P. A., HILTON, M. F., MUSPRATT, A., NG, S. K. & WHITEFORD, H. A. 2011. Patterns of multimorbidity in working Australians. *Popul Health Metr,* 9**,** 15.

HOU, W. H., LIANG, H. W., HSIEH, C. L., SHEU, C. F., HWANG, J. S. & CHUANG, H. Y. 2013. Integrating health-related quality of life with sickness leave days for return-to-work assessment in traumatic limb injuries. *Quality of Life Research,* 22**,** 2307-14.

HUGHES, M. C., GIROLAMI, T. M., CHEADLE, A. D., HARRIS, J. R. & PATRICK, D. L. 2007. A lifestyle-based weight management program delivered to employees: examination of health and economic outcomes (Structured abstract). *Journal of Occupational and Environmental Medicine* [Online]. Available: http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-22007006751/frame.html.

HUSEREAU D, D. M., PETROU S, CARSWELL C, MOHER D, GREENBERG D, AUGUSTOVSKI F, BRIGGS AH, MAUSKOPF J, LODER E, 2013a. Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement. *BMC Medicine,* 11.

HUSEREAU D, D. M., PETROU S, ET AL. 2013b. Consolidated health economic evaluation reporting standards (CHEERS)—Explanation and elaboration: A report of the ISPOR health economic evaluations publication guidelines good reporting practices task force. *Value Health 2013;16:231-50.*

ICHIHASHI, T., MUTO, T. & SHIBUYA, K. 2007. Cost-benefit analysis of a worksite oral-health promotion program. *Ind Health,* 45**,** 32-6.

IDE, R., MIZOUE, T., TSUKIYAMA, Y., IKEDA, M. & YOSHIMURA, T. 2001. Evaluation of oral health promotion in the workplace: the effects on dental care costs and frequency of dental visits. *Community Dent Oral Epidemiol,* 29**,** 213-9.

IGLESIAS, C. P., DRUMMOND, M. F. & ROVIRA, J. 2005. Health-care decision-making processes in Latin America: problems and prospects for the use of economic evaluation. *Int J Technol Assess Health Care,* 21**,** 1-14.

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE 2005. "Guidelines for the data processing and analysis of the International Physical Activity Questionnaire", Revised November, 2005, downloaded from http://www.ipaq.ki.se [Online].

JARMAN, L., MARTIN, A., VENN, A., OTAHAL, P., TAYLOR, R., TEALE, B. & SANDERSON, K. 2014. Prevalence and correlates of psychological distress in a large and diverse public sector workforce: baseline results from Partnering Healthy@ Work. *BMC public health,* 14**,** 125.

JEFFERY, R. W., FORSTER, J. L., DUNN, B. V., FRENCH, S. A., MCGOVERN, P. G. & LANDO, H. A. 1993. Effects of work-site health promotion on illness-related absenteeism. *Journal of Occupational and Environmental Medicine,* 35**,** 1142.

JOHNS, G. 2010. Presenteeism in the workplace: A review and research agenda. *Journal of Organizational Behavior,* 31**,** 519-542.

JONES, R. C., BLY, J. L. & RICHARDSON, J. E. 1990. A study of a work site health promotion program and absenteeism. *J Occup Med,* 32**,** 95-9.

KELLER, P. A., LEHMANN, D. R. & MILLIGAN, K. J. 2009. Effectiveness of Corporate Well-Being Programs A Meta-Analysis. *Journal of Macromarketing,* 29**,** 279-302.

KESSLER, R. C., AMES, M., HYMEL, P. A., LOEPPKE, R., MCKENAS, D. K., RICHLING, D. E., STANG, P. E. & USTUN, T. B. 2004. Using the World Health Organization Health and Work Performance Questionnaire (HPQ) to evaluate the indirect workplace costs of illness. *Journal of Occupational and Environmental Medicine,* 46**,** S23-S37.

KESSLER, R. C., ANDREWS, G., COLPE, L. J., HIRIPI, E., MROCZEK, D. K., NORMAND, S.-L. T., WALTERS, E. E. & ZASLAVSKY, A. M. 2002. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological medicine,* 32**,** 959-976.

KESSLER, R. C., BARBER, C., BECK, A., BERGLUND, P., CLEARY, P. D., MCKENAS, D., PRONK, N., SIMON, G., STANG, P. & USTUN, T. B. 2003. The world health organization health and work performance questionnaire (HPQ). *Journal of Occupational and Environmental Medicine,* 45**,** 156-174.

KHANNA, D., FURST, D. E., WONG, W. K., TSEVAT, J., CLEMENTS, P. J., PARK, G. S., POSTLETHWAITE, A. E., AHMED, M., GINSBURG, S. & HAYS, R. D. 2007. Reliability, validity, and minimally important differences of the SF-6D in systemic sclerosis. *Quality of Life Research,* 16**,** 1083-1092.

KILPATRICK, M., SANDERSON, K., BLIZZARD, L., TEALE, B. & VENN, A. 2013. Cross-sectional associations between sitting at work and psychological distress: reducing sitting time may benefit mental health. *Mental Health and Physical Activity,* 6**,** 103-109.

KILPATRICK, M. B., C.L. SANDERSON, K. TEALE, BC. VENN, AJ., In press. Factors associated with availability of, and employee participation in, comprehensive workplace health promotion (WHP) in a large and diverse Australian public-sector setting: a cross-sectional survey. *Journal of Occupational and Environmental Medicine*.

KNIGHT, K. K., GOETZEL, R. Z., FIELDING, J. E., EISEN, M., JACKSON, G. W., KAHR, T. Y., KENNY, G. M., WADE, S. W. & DUANN, S. 1994. An evaluation of Duke University's LIVE FOR LIFE health promotion program on changes in worker absenteeism. *J Occup Med,* 36**,** 533-6.

KOOPMANSCHAP, M., BURDORF, A., JACOB, K., MEERDING, W. J., BROUWER, W. & SEVERENS, H. 2005. Measuring productivity changes in economic evaluation: setting the research agenda. *Pharmacoeconomics,* 23**,** 47-54.

KOOPMANSCHAP, M. A., RUTTEN, F. F., VAN INEVELD, B. M. & VAN ROIJEN, L. 1995. The friction cost method for measuring indirect costs of disease. *Journal of Health Economics,* 14**,** 171-89.

KUDIELKA, B. M., HANEBUTH, D., VON KANEL, R., GANDER, M. L., GRANDE, G. & FISCHER, J. E. 2005. Health-related quality of life measured by the SF12 in working populations: associations with psychosocial work characteristics. *J Occup Health Psychol,* 10**,** 429-40.

KUMPULAINEN, V. & MAKELA, M. 1997. Influenza vaccination among healthy employees: a cost-benefit analysis. *Scandinavian Journal of Infectious Diseases* [Online]. Available: http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-21997000750/frame.html.

LAM, C. L., BRAZIER, J. & MCGHEE, S. M. 2008. Valuation of the SF-6D health states is feasible, acceptable, reliable, and valid in a Chinese population. *Value in Health,* 11**,** 295-303.

LERNER, D., RODDAY, A. M., COHEN, J. T. & ROGERS, W. H. 2013. A Systematic Review of the Evidence Concerning the Economic Impact of Employee-Focused Health Promotion and Wellness Programs. *Journal of Occupational and Environmental Medicine,* 55**,** 209-222.

LERNER, D. J., LEVINE, S., MALSPEIS, S. & D'AGOSTINO, R. B. 1994. Job strain and health-related quality of life in a national sample. *American journal of public health,* 84**,** 1580-1585.

LEUNG, Y. Y., PNG, M. E., WEE, H. L. & THUMBOO, J. 2013. Comparison of EuroQol-5D and short form-6D utility scores in multiethnic Asian patients with psoriatic arthritis: a cross-sectional study. *J Rheumatol,* 40**,** 859-65.

LEUTZINGER, J., HAWES, C., HUNNICUTT, D. & RICHLING, D. 1995. Predicting the ratio of benefit to cost in a cardiovascular disease-prevention program. *Managing Employee Health Benefits,* 3**,** 1-10.

LI, C. Y. & SUNG, F. C. 1999. A review of the healthy worker effect in occupational epidemiology. *Occup Med (Lond),* 49**,** 225-9.

LINNAN, L., BOWLING, M., CHILDRESS, J., LINDSAY, G., BLAKEY, C., PRONK, S., WIEKER, S. & ROYALL, P. 2008. Results of the 2004 National Worksite Health Promotion Survey. *Am J Public Health,* 98**,** 1503-9.

LOEF, M. & WALACH, H. 2012. The combined effects of healthy lifestyle behaviors on all cause mortality: a systematic review and meta-analysis. *Preventive medicine,* 55**,** 163-170.

LONGWORTH, L. & BRYAN, S. 2003. An empirical comparison of EQ-5D and SF-6D in liver transplant patients. *Health Economics,* 12**,** 1061-1067.

LORGELLY, P. K. L., K.D. ELISABETH A.L. FENWICK, E.A.L. AND BRIGGS, A.H. 2010. Outcome Measurement in Economic Evaluations of Public Health Interventions: a Role for the Capability Approach? *International Journal of Environmental Research and Public Health Monograph,* 7**,** 2274-2289.

LYNCH, W. D., GOLASZEWSKI, T. J., CLEARIE, A. F., SNOW, D. & VICKERY, D. M. 1990. Impact of a facility-based corporate fitness program on the number of absences from work due to illness. *Journal of occupational medicine.: official publication of the Industrial Medical Association,* 32**,** 9.

MAES, S., VERHOEVEN, C., KITTEL, F. & SCHOLTEN, H. 1998. Effects of a Dutch work-site wellness-health program: the Brabantia Project. *American journal of public health,* 88**,** 1037-1041.

MALIK, S. H., BLAKE, H. & SUGGS, L. S. 2014. A systematic review of workplace health promotion interventions for increasing physical activity. *Br J Health Psychol,* 19**,** 149-80.

MARMOT, M. & BRUNNER, E. 2005. Cohort profile: the Whitehall II study. *International Journal of Epidemiology,* 34**,** 251-256.

MARRA, C. A., WOOLCOTT, J. C., KOPEC, J. A., SHOJANIA, K., OFFER, R., BRAZIER, J. E., ESDAILE, J. M. & ANIS, A. H. 2005. A comparison of generic, indirect utility measures (the HUI2, HUI3, SF-6D, and the EQ-5D) and disease-specific instruments (the RAQoL and the HAQ) in rheumatoid arthritis. *Social Science & Medicine,* 60**,** 1571-1582.

MAUSKOPF, J. A., PAUL, J. E., GRANT, D. M. & STERGACHIS, A. 1998. The Role of Cost—Consequence Analysis in Healthcare Decision—Making. *Pharmacoeconomics,* 13**,** 277-288.

MCCRONE, P., PATEL, A., KNAPP, M., SCHENE, A., KOETER, M., AMMADEO, F., RUGGERI, M., GIESSLER, A., PUSCHNER, B. & THORNICROFT, G. 2009. A comparison of SF-6D and EQ-5D utility scores in a study of patients with schizophrenia. *Journal of mental health policy and economics,* 12**,** 27-31.

MCDAID, D. N., J. *What use has been made of economic evaluation in public health? A systematic review of the literature*, Dawson, S. Morris, ZS. editors Future Public Health: Burdens, Challenges and Opportunities. Basingstone: Palgrave Macmillan.

MCEACHAN, R. R., LAWTON, R. J., JACKSON, C., CONNER, M., MEADS, D. M. & WEST, R. M. 2011. Testing a workplace physical activity intervention: a cluster randomized controlled trial. *Int J Behav Nutr Phys Act,* 8**,** 29.

MCINTOSH, E., CLARKE, P., FREW, E. & LOUVIERE, J. 2010. *Applied methods of cost-benefit analysis in health care*, OUP Oxford.

MCLEROY, K. R., BIBEAU, D., STECKLER, A. & GLANZ, K. 1988. An ecological perspective on health promotion programs. *Health Education & Behavior,* 15**,** 351-377.

MDEGE, N. D., MAN, M.-S., TAYLOR, C. A. & TORGERSON, D. J. 2011. Systematic review of stepped wedge cluster randomized trials shows that design is particularly used to evaluate interventions during routine implementation. *Journal of clinical epidemiology,* 64**,** 936-948.

MEDICAL RESEARCH COUNCIL 2006. Developing and evaluating complex interventinos: new guidance. Available at http://www.mrc.ac.uk/documents/pdf/complex-interventions-guidance/.

MEENAN, R. T., VOGT, T. M., WILLIAMS, A. E., STEVENS, V. J., ALBRIGHT, C. L. & NIGG, C. 2010. Economic evaluation of a worksite obesity prevention and intervention trial among hotel workers in Hawaii. *Journal of Occupational and Environmental Medicine,* 52**,** S8-S13.

MENN, P., WEBER, N. & HOLLE, R. 2010. Research Health-related quality of life in patients with severe COPD hospitalized for exacerbations-comparing EQ-5D, SF-12 and SGRQ. *Health and Quality of Life Outcomes,* 8**,** 1-9.

MERRILL, R. M., HYATT, B., ALDANA, S. G. & KINNERSLEY, D. 2011. Lowering Employee Health Care Costs Through the Healthy Lifestyle Incentive Program. *Journal of Public Health Management and Practice,* 17**,** 225-232.

MESSNER W. 2013. *Making the Compelling Business Case: Decision Making Techniques for Successful Business Growth,* Houndmills, Palgrave Macmillan.

MILANI, R. V. & LAVIE, C. J. 2009. Impact of worksite wellness intervention on cardiac risk factors and one-year health care costs. *Am J Cardiol,* 104**,** 1389-92.

MILAT, A. J., KING, L., BAUMAN, A. E. & REDMAN, S. 2013. The concept of scalability: increasing the scale and potential adoption of health promotion interventions into policy and practice. *Health Promotion International,* 28**,** 285-98.

MILLOT, J. L., AYMARD, M. & BARDOL, A. 2002. Reduced efficiency of influenza vaccine in prevention of influenza-like illness in working adults: A 7 month prospective survey in EDF Gaz de France employees, in Rhône-Alpes, 1996-1997. *Occupational Medicine,* 52**,** 281-292.

MILLS, P. R., KESSLER, R. C., COOPER, J. & SULLIVAN, S. 2007. Impact of a health promotion program on employee health risks and work productivity. *Am J Health Promot,* 22**,** 45-53.

MORALES, A., MARTINEZ, M. M., TASSET-TISSEAU, A., REY, E., BARON-PAPILLON, F. & FOLLET, A. 2004. Costs and benefits of influenza vaccination and work productivity in a Colombian company from the employer's perspective. *Value in Health,* 7**,** 433-441.

MOSSINK, J. A. D. G., M., 2002. Inventory of socioeconomic costs and work accidents European Agency for Safety and Health at Work Available at https://www.osha.europa.eu/en/publications/reports/207 Accessed on May 2015. *In:* HEALTH, T. C. O. R.-W. A. (ed.). Luxembourg: Office for Official Publications of teh Europoean Communities.

MUSHKIN, S. J. 1958. Toward a definition of health economics. *Public Health Reports,* 73**,** 785-93.

NAIMI, A. I., RICHARDSON, D. B. & COLE, S. R. 2013. Causal inference in occupational epidemiology: accounting for the healthy worker effect by using structural nested models. *American Journal of Epidemiology,* 178**,** 1681-6.

NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE 2007. The Guidelines Manual: Chapter 8; Incorportaing health economics in guidelines and assessing resource impact (April 2007) http://www.nice.org.uk/niceMedia/pdf/GuidelinesManualChapter8.pdf.

NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE. 2008. *Promoting physical activity in the workplace: business case http://guidance.nice.org.uk/PH13/BusinessCase/xls/English* [Online].

NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE 2009a. The Guidelines Manual: Appendix H: Methodology checklist - economic evaluations (January 2009) http://www.nice.org.uk/media/633/71/The_guidelines_manual_2009_-_Appendix_H_Methodology_checklist_-_economic_evaluations.pdf.

NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE 2009b. Methods for development of NICE public health guidance. Second edition NICE London. Available at http://www.nice.org.uk/media/2FB/53/PHMethodsManual110509.pdf Accessed May 2015.

NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE Promoting physical activity in the workplace: review decision document (2014). Accessed 14 March, 2015. Available at http://www.nice.org.uk/guidance/ph13/documents

NAYDECK, B. L., PEARSON, J. A., OZMINKOWSKI, R. J., DAY, B. T. & GOETZEL, R. Z. 2008. The impact of the highmark employee wellness programs on 4-year healthcare costs. *J Occup Environ Med,* 50**,** 146-56.

NELSON C.F. VEROFF D. 2015. Chapter 8: Value on Investment Framework. In Program Measurement and Evaluation Guide: Core Metrics for Employee Health Management. Health Enhancement Research Organization (HERO) and Population Health Alliance (PHA). Available at: http://hero-health.org/wp-content/uploads/2015/02/HERO-PHA-Metrics-Guide-FINAL.pdf Accessed April 2015.

NELSON, D. J., SENNETT, L. & LEFEBVRE, R. C. 1987. A campaign strategy for weight loss at worksites. *Health Education Research,* 2**,** 27-31.

NEWMAN, L., BAUM, F. & HARRIS, E. 2006. Federal, State and Territory government responses to health inequities and the social determinants of health in Australia. *Health promotion journal of Australia,* 17**,** 217.

NATIONAL HEALTH SERVICE (NHS);. *Workplace Wellbeing Charter, National Award for England* [Online]. Liverpool City Council. Available: http://wellbeingcharter.org.uk [Accessed 5th December 2014].

NIEBUHR, S. & GROSSMEIER, J. 2015. Is it time for a broader approach? Recasting the value of "employee health" with a focus on workforce capability. The Art of Health Promotion *The American Journal of Health Promotion,* July/August DOI: 10.4278/ajhp.29.6.tahp**,** TAHP-6-9.

NIXON, J., STOYKOVA, B., GLANVILLE, J., CHRISTIE, J., DRUMMOND, M. & KLEIJNEN, J. 2000. The U.K. NHS economic evaluation database. Economic issues in evaluations of health technology. *Int J Technol Assess Health Care,* 16**,** 731-42.

NORMAN, R., CHURCH, J., VAN DEN BERG, B. & GOODALL, S. 2013. Australian health-related quality of life population norms derived from the SF-6D. *Australian and New Zealand journal of public health,* 37**,** 17-23.

NUTBEAM, D. 1998. Evaluating health promotion—progress, problems and solutions. *Health promotion international,* 13**,** 27.

NYMAN, J. A., ABRAHAM, J. M., JEFFERY, M. M. & BARLEEN, N. A. 2012. The Effectiveness of a Health Promotion Program After 3 Years: Evidence From the University of Minnesota. *Med Care,* 50**,** 772-778.

O'DONNELL, M. 2015a. *Health Promotion In The Workplace 4th edition*.

O'DONNELL, M. P. 2014. What is the ROI of workplace health promotion? The answer just got simpler by making the question more complicated. *American Journal of Health Promotion,* 28**,** iv-v.

O'DONNELL, M. P. 2015b. What Is the ROI for Workplace Health Promotion? It Really Does Depend, and That's the Point. *American Journal of Health Promotion,* 29**,** v-viii.

O'DONNELL, M. P. & AINSWORTH, T. H. 1984. Health Promotion in the Workplace. *AJN The American Journal of Nursing,* 84**,** 1484.

OFMAN, J. J., SULLIVAN, S. D., NEUMANN, P. J., CHIOU, C. F., HENNING, J. M., WADE, S. W. & HAY, J. W. 2003. Examining the value and quality of health economic analyses: implications of utilizing the QHES. *Journal of Managed Care Pharmacy,* 9**,** 53-61.

OLDENBURG, B., SALLIS, J. F., HARRIS, D. & OWEN, N. 2002. Checklist of Health Promotion Environments at Worksites (CHEW): development and measurement characteristics. *Am J Health Promot,* 16**,** 288-99.

OLECKNO W. 2002. *Essential Epidemiology: Principles and Applications,* Long Grove, Illinois, Waveland press, Inc.

OSILLA, K. C., VAN BUSUM, K., SCHNYER, C., LARKIN, J. W., EIBNER, C. & MATTKE, S. 2012. Systematic review of the impact of worksite wellness programs. *American Journal of Managed Care,* 18**,** e68-81.

OXMAN, A. & GROUP, G. W. 2004. Grading quality of evidence and strength of recommendations. *BMJ,* 328**,** 1490-4.

OZMINKOWSKI, R. J., DUNN, R. L., GOETZEL, R. Z., CANTOR, R. I., MURNANE, J. & HARRISON, M. 1999. A return on investment evaluation of the Citibank, N.A., health management program. *Am J Health Promot,* 14**,** 31-43.

PAGE, M. J., PARAMORE, L. C., DOSHI, D. & RUPNOW, M. F. T. 2009. Evaluation of resource utilization and cost burden before and after an employer-based migraine education program. *Journal of Occupational and Environmental Medicine,* 51**,** 213-220.

PARLIAMENT OF AUSTRALIA 2014. Budget papers 2014-15; Health. Commonwealth of Australia; 2014. Available at www.budget.gov.au. Canberra Australia.

PATIENT PROTECTION AND AFFORDABLE CARE ACT 2010. Subtitle D-Provisions Relating to Title IV. HR 3590 EAS/PP Available at http://www.hhs.gov/healthcare/rights/law/title/iv-amendments.pdf Accessed March 2014.

PELLETIER, K. R. 1999. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: 1995-1998 update (IV). *Am J Health Promot,* 13**,** 333-45, iii.

PELLETIER, K. R. 2005. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: update VI 2000-2004. *J Occup Environ Med,* 47**,** 1051-8.

PELLETIER, K. R. 2011. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: update VIII 2008 to 2010. *J Occup Environ Med,* 53**,** 1310-31.

PETROU, S. & HOCKLEY, C. 2005. An investigation into the empirical validity of the EQ-5D and SF-6D based on hypothetical preferences in a general population. *Health economics,* 14**,** 1169-1189.

PHILIPS, Z., BOJKE, L., SCULPHER, M., CLAXTON, K. & GOLDER, S. 2006. Good practice guidelines for decision-analytic modelling in health technology assessment: a review and consolidation of quality assessment. *Pharmacoeconomics,* 24**,** 355-71.

PIETERSMA, S., DE VRIES, M. & VAN DEN AKKER-VAN MARLE, M. E. 2014. Domains of quality of life: results of a three-stage Delphi consensus procedure among patients, family of patients, clinicians, scientists and the general public. *Quality of Life Research,* 23**,** 1543-56.

POPULATION REFERENCE BUREAU 2012. World population Data Sheet. Available at http://www.prb.org/Publications/Datasheets/2012/world-population-data-sheet.aspx.

PREMIER'S PHYSICAL ACTIVITY COUNCIL 2007. Get Moving at Work: A resource kit for workplace health and wellbeign programs Available at www.getmoving.tas.gov.au Accessed August 2014.

PRICEWATERHOUSECOOPERS AND MEDIBANK HEALTH SOLUTIONS 2010. Workplace wellness in Australia; aligning action with aims: Optimising the benefits of workplace wellness. www.pwc.com.au.

PRICEWATERHOUSECOOPERS LLP Building the case for wellness, London: PWC 2008. Accessed from http://www.dwp.gov.uk/docs/hwwb-dwp-wellness-report-public.pdf.

PROPER, K. I., DE BRUYNE, M. C., HILDEBRANDT, V. H., VAN DER BEEK, A. J., MEERDING, W. J. & VAN MECHELEN, W. 2004. Costs, benefits and effectiveness of worksite physical activity counseling from the employer's perspective. *Scandinavian Journal of Work, Environment and Health,* 30**,** 36-46.

QUEENSLAND HEALTH 1996. Better health for Working People: Guidling Principles. *In:* QLD HEALTH (ed.). Brisbane, Australia.

RENAUD, L., KISHCHUK, N., JUNEAU, M., NIGAM, A., TETREAULT, K. & LEBLANC, M. C. 2008. Implementation and outcomes of a comprehensive worksite health promotion program. *Canadian Journal of Public Health,* 99**,** 73-77.

RICHARDSON J, IEZZI A, KHAN MA & MAXWELL A 2012. Cross-national comparison of twelve quality of life instruments. MIC Paper 2. Melbourne: Centre for Health Economics, Monash University.

RICHARDSON J, M. J., BARIOLA E., 2011. Review and Critique of Health Related Multi Attribute Utility Instruments In: Culyer A, editor.Encyclopedia of health economics. San Diego: Elsevier Science; in press. Available from: http://www.buseco.monash.edu.au/centres/che/pubs/researchpaper64.pdf.

RICKLES D, H. P., SHIELL A. 2007. A simple guide to chaos and complexity. *J Epidemiol Community Health,* 61**,** 93-7.

ROBINSON, L. 2010. How to Change the World One Conversation at a Time: The Art of Hosting Action Conversations. Les Robinson and the Australian Conservation Foundation.

RONGEN, A., ROBROEK, S. J. W., VAN LENTHE, F. J. & BURDORF, A. 2013. Workplace Health Promotion: A Meta-Analysis of Effectiveness. *American journal of preventive medicine,* 44**,** 406-415.

RUSLI, B. N., EDIMANSYAH, B. A. & NAING, L. 2008. Working conditions, self-perceived stress, anxiety, depression and quality of life: a structural equation modelling approach. *BMC Public Health,* 8**,** 48.

RYCHETNIK, L., BAUMAN, A., LAWS, R., KING, L., RISSEL, C., NUTBEAM, D., COLAGIURI, S. & CATERSON, I. 2012. Translating research for evidence-based public health: key concepts and future directions. *J Epidemiol Community Health,* 66**,** 1187-92.

RYCHETNIK, L., FROMMER, M., HAWE, P. & SHIELL, A. 2002. Criteria for evaluating evidence on public health interventions. *Journal of Epidemiology and Community Health,* 56**,** 119-27.

SACKS, G., VEERMAN, J. L., MOODIE, M. & SWINBURN, B. 2011. 'Traffic-light'nutrition labelling and 'junk-food'tax: a modelled comparison of cost-effectiveness for obesity prevention. *International Journal of Obesity,* 35**,** 1001-1009.

SAHA, S., GERDTHAM, U.-G. & JOHANSSON, P. 2010. Economic evaluation of lifestyle interventions for preventing diabetes and cardiovascular diseases. *International journal of environmental research and public health,* 7**,** 3150-3195.

SALLIS, J. F., OWEN, N. & FISHER, E. B. 2008. Ecological models of health behavior. *Health behavior and health education: Theory, research, and practice,* 4**,** 465-486.

SAMAD, A. H., USUL, M. H. B. H. J., ZAKARIA, D., ISMAIL, R., TASSET-TISSEAU, A., BARON-PAPILLON, F. & FOLLET, A. 2006. Workplace vaccination against influenza in Malaysia: Does the employer benefit? *Journal of Occupational Health,* 48**,** 1-10.

SANDERSON, K. & ANDREWS, G. 2002. The SF-12 in the Australian population: cross-validation of item selection. *Australian and New Zealand journal of public health,* 26**,** 343-345.

SANDERSON, K. & COCKER, F. 2013. Presenteeism: Implications and health risks. *Australian family physician,* 42**,** 172.

SANDERSON, K., TILSE, E., NICHOLSON, J., OLDENBURG, B. & GRAVES, N. 2007. Which presenteeism measures are more sensitive to depression and anxiety? *Journal of affective disorders,* 101**,** 65-74.

SAX INSTITUTE Available at https://www.saxinstitute.org.au.

SCHNEIDER, M. & HÄCK, H. J. 2011. Screening for colorectal cancer: A cost benefit analysis on a health prevention programme at the Boehringer Ingelheim Company. *Darmkrebsscreening im betrieblichen Umfeld: Kosten-Nutzen-Analyse einer Maßnahme zur Gesundheitsförderung bei Boehringer Ingelheim,* 136**,** 1047-1052.

SCHRAMMEL, P., GRIFFITHS, R. I. & GRIFFITHS, C. B. 1998. A workplace breast cancer screening program: Costs and components. *AAOHN Journal,* 46**,** 523-529.

SCHULTZ, A. B. & EDINGTON, D. W. 2007. Employee health and presenteeism: a systematic review. *J Occup Rehabil,* 17**,** 547-79.

SCHULTZ, A. B., LU, C., BARNETT, T. E., YEN, L. T., MCDONALD, T., HIRSCHLAND, D. & EDINGTON, D. W. 2002. Influence of participation in a worksite health-promotion program on disability days. *J Occup Environ Med,* 44**,** 776-80.

SCHWARTZ, S. M., DAY, B., WILDENHAUS, K., SILBERMAN, A., WANG, C. & SILBERMAN, J. 2010. The impact of an online disease management program on medical costs among health plan members. *American journal of health promotion,* 25**,** 126-133.

SCIACCA, J., SEEHAFER, R., REED, R. & MULVANCY, D. 1993. The impact of participation in health promotion on medical costs: A reconsideration of the Blue Cross and Blue Shield of Indiana study. *American Journal of Health Promotion,* 7**,** 374-383+395.

SEN, A. 1993. *Capability and well-being*, na.

SERXNER, S., ADAMS, V. G., HUNDAHL, L. S., LAU, S., ADESSA JR, C. J. & HOPKINS, D. 1993. A smoking cessation pilot program. *Hawaii medical journal,* 52**,** 266-272.

SERXNER, S., GOLD, D., ANDERSON, D. & WILLIAMS, D. 2001. The impact of a worksite health promotion program on short-term disability usage. *J Occup Environ Med,* 43**,** 25-9.

SERXNER, S. A., GOLD, D. B., GROSSMEIER, J. J. & ANDERSON, D. R. 2003. The relationship between health promotion program participation and medical costs: a dose response. *J Occup Environ Med,* 45**,** 1196-200.

SHEMILT I, M. M., VALE L, MARSH K, DONALDSON C (EDITORS) 2010. *Evidence-based decisions and economics : health care, social welfare, education and criminal justice,* Chichester, West Sussex, UK ; Hoboken, NJ, Wiley-Blackwell/BMJ Books.

SHEMILT, I. M., M. BYFORS, S. DRUMMOND, M. ET AL ON BEHALF OF THE CAMPBELL AND COCHRANE ECONOMICS METHODS GROUP Incorporating economics evidence. In: Higgins JPT, Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org

SHEPHARD, R. J. 1992. Twelve years experience of a fitness program for the salaried employees of a Toronto Life Assurance Company. *American Journal of Health Promotion,* 6**,** 292-301.

SHEPHARD, R. J., COREY, P., RENZLAND, P. & COX, M. 1982. The influence of an employee fitness and lifestyle modification program upon medical care costs. *Canadian journal of public health. Revue canadienne de sante publique,* 73**,** 259.

SHI, L. 1993a. Health promotion, medical care use, and costs in a sample of worksite employees. *Evaluation Review,* 17**,** 475-487.

SHI, L. 1993b. Worksite health promotion and changes in medical care use and sick days. *Health Values: The Journal of Health Behavior, Education & Promotion,* 17**,** 9-17.

SHIELL, A. & HAWE, P. 1996. Health promotion community development and the tyranny of individualism. *Health Economics,* 5**,** 241-7.

SHIELL, A., HAWE, P. & GOLD, L. 2008. Complex interventions or complex systems? Implications for health economic evaluation. *BMJ,* 336**,** 1281-3.

SHIELL, A. H., P. JAN, S., 2013. Feature Essay: The Economic Value of Prevention in State of Preventive Health 2013. Available at http://anpha.gov.au/internet/anpha/publishing.nsf/Content/state-of-prev-health-2013 Accessed November 2013.

SHIMIZU, T., NAGASHIMA, S., MIZOUE, T., HIGASHI, T. & NAGATA, S. 2003. A psychosocial-approached health promotion program at a Japanese worksite. *J UOEH,* 25**,** 23-34.

SHORE, G., PRASAD, P. & ZROBAK, M. 1989. Metrofit: A cost-effective fitness program. *Fitness in Business,* 4**,** 147-153.

SIEGRIST, J., STARKE, D., CHANDOLA, T., GODIN, I., MARMOT, M., NIEDHAMMER, I. & PETER, R. 2004. The measurement of effort–reward imbalance at work: European comparisons. *Social Science & Medicine,* 58**,** 1483-1499.

SILVA, L. S. & BARRETO, S. M. 2012. Adverse psychosocial working conditions and poor quality of life among financial service employees in Brazil. *J Occup Health,* 54**,** 88-95.

SMITH, B. J., TANG, K. C. & NUTBEAM, D. 2006. WHO Health Promotion Glossary: new terms. *Health Promot Int,* 21**,** 340-5.

SMITH, R., LORGELLY, P., AL-JANABI, H., VENKATAPURAM, S. & COAST, J. 2012. 39 The capability approach: an alternative evaluation paradigm for health economics? Available at https://books.google.com.au/books?hl=en&lr=&id=6uPX9XeS9g4C&oi=fnd&pg=PA415&dq=AL-JANABI+2012+capability+approach&ots=EH1uIb0f3X&sig=Uf5x93J_0pd04bBnZttUJOH5rxo#v=onepage&q&f=false. *The elgar companion to health economics*, 415.

SOCKOLL, I. K., I. AND BOEDEKER, W. Effectiveness and economic benefits of workplace health promotion and prevention: Summary of the scientific evidence 2000-2006 IGA-Report 13e Available at http://www.enwhp.org/publications/other-publications.html Accessed April 2015.

STASON, W. 1984. Measuring the" payoff" of worksite health strategies. *Business and health,* 1**,** 19.

STAVE, G. M., MUCHMORE, L. & GARDNER, H. 2003. Quantifiable impact of the contract for health and wellness: health behaviors, health care costs, disability, and workers' compensation (Provisional abstract). *Journal of Occupational and Environmental Medicine* [Online]. Available: http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-22003000418/frame.html.

STEIN, A. D., KAREL, T. & ZUIDEMA, R. 1999. Carrots and sticks: impact of an incentive/disincentive employee flexible credit benefit plan on health status and medical costs. *Am J Health Promot,* 13**,** 260-7.

STEVENS, D. E. 2014. Phase II: Developing the Business Case - World Cafe Results. Role of Corporate America in Community Health and Wellness. Available at www.the-hero.org Accessed in *Health Enhancement Research Organization (HERO).* MATRIX Public Health Solutions Inc.

STINNETT, A. A. & MULLAHY, J. 1998. Net health benefits: a new framework for the analysis of uncertainty in cost-effectiveness analysis. *Medical Decision Making,* 18**,** S68-80.

STONE, P. W. 2005. Return-on-investment models. *Applied nursing research: ANR,* 18**,** 186.

TAIMELA, S., JUSTÉN, S., ARONEN, P., SINTONEN, H., LÄÄRÄ, E., MALMIVAARA, A., TIEKSO, J. & ARO, T. 2008. An occupational health intervention programme for workers at high risk for sickness absence. Cost effectiveness analysis based on a randomised controlled trial. *Occupational and Environmental Medicine,* 65**,** 242-248.

TAO, X., CHENOWETH, D., ALFRIEND, A. S., BARON, D. M., KIRKLAND, T. W., SCHERB, J. & BERNACKI, E. J. 2009. Monitoring worksite clinic performance using a cost-benefit tool. *Journal of Occupational and Environmental Medicine,* 51**,** 1151-1157.

TASMANIAN AUDIT OFFICE 2010. Auditor-General Special report No. 92. Public sector productivity: a ten-year comparison. Available at http://www.audit.tas.gov.au/search/special+report Accessed on Sept 2014. Hobart: Parliament of Tasmania, Australia.

TASMANIAN DEPARTMENT OF HEALTH AND HUMAN SERVICES (DHHS). 2009. *Connecting care: Chronic Disease Action Framework for Tasmania 2009–2013 Available at http://www.dhhs.tas.gov.au/__data/assets/pdf_file/0006/48390/Connecting_Care_Full_Version_web.pdf Accessed Nov 2014* [Online]. Hobart, Tasmanian Government.

TASMANIAN GOVERNMENT DEPARTMENT OF HEALTH AND HUMAN SERVICES. 2010. *Working in Health Promoting Ways: a Strategic Framework Available at http://www.dhhs.tas.gov.au/healthpromotion/wihpw Accessed May 2015* [Online]. Hobart, Tasmania.

TASMANIAN GOVERNMENT DEPARTMENT OF HEALTH AND HUMAN SERVICES WITH AUSTRALIAN NETWORK FOR PROMOTION, P. A. E. I. F. M. H. A. A. I. C. W. P. D. R., UNIVERSITY OF CANBERRA,. 2009. *Building the Foundations: Strategic Framework Available at http://www.dhhs.tas.gov.au/mentalhealth/publications/strategic_documents Accessed March 2013* [Online].

TASMANIAN GOVERNMENT DEPARTMENT OF PREMIER AND CABINET, P. S. M. O. 2009a. Healthy@Work Strategic Plan. Hobart, Tasmania.

TASMANIAN GOVERNMENT DEPARTMENT OF PREMIER AND CABINET, P. S. M. O. 2009b. People Directions: delivering quality services for Tasmanians. Hobart, Tasmania.

TASMANIAN GOVERNMENT PREMIER'S PHYSICAL ACTIVITY COUNCIL. 2011. *Tasmania's Plan for Physical Activity 2011-2021. Developed in consultation with the Tasmanian Community. Available at http://www.getmoving.tas.gov.au/__data/assets/pdf_file/0010/51112/TPPA_A4_LOW_RES.pdf Accessed May 2015* [Online]. Hobart, Tasmania.

TASMANIAN STATE GOVERNMENT DEPARTMENT OF PREMIER AND CABINET. *Employment Direction 23: Workplace Health and Wellbeing Available at http://www.dpac.tas.gov.au/__data/assets/pdf_file/0006/186036/ED23_WorkplaceHealthAndWellbeing.PDF Accessed on June 18, 2015* [Online].

TASMANIAN STATE GOVERNMENT DEPARTMENT OF PREMIER AND CABINET Ministerial Direction 23 Guidelines; Implementing a Workplace Health and Wellbeing Program Available at http://www.dpac.tas.gov.au/__data/assets/pdf_file/0006/123855/Ministerial_Direction_23_Guidelines.pdf Accessed on 15 November, 2014.

TASMANIAN STATE GOVERNMENT DEPARTMENT OF PREMIER AND CABINET 2012. Healthy@Work: Project Review and Closure Report.

TERRY, P. E. 2015. The industrial-strength tools needed for improving health promotion practice and fostering a shift to well-being. The Art of Health Promotion *The American Journal of Health Promotion,* July/August DOI: 10.4278/ajhp.29.6.tahp**,** TAHP-11-12.

TERRY, P. E., GROSSMEIER, J., HUDSMITH, N., NIEBUHR, S. & FLYNN, J. 2015. The Art of Health Promotion ideas for improving health outcomes Editor's Desk: The Value Issue. *The American Journal of Health Promotion,* July/August DOI: 10.4278/ajhp.29.6.tahp.

THE EUROPEAN NETWORK FOR HEALTH PROMOTION (ENWHP) Publications available at http://www.enwhp.org/publications.html Accessed 10 April, 2015.

THE ROYAL AUSTRALIAN COLLEGE OF GENERAL PRACTITIONERS Guidelines for preventive activities in general practice 8th edition, Appendix C: Audit-C. Available at: http://www.racgp.org.au/your-practice/guidelines/redbook/appendices/appendix-3-audit-c/.

TRUDEAU, J. V., DEITZ, D. K. & COOK, R. F. 2002. Utilization and cost of behavioral health services: employee characteristics and workplace health promotion. *The Journal of Behavioral Health Services and Research,* 29**,** 61-74.

TSAI, S. P., BERNACKI, E. J. & BAUN, W. B. 1988. Injury prevalence and associated costs among participants of an employee fitness program. *Preventive medicine,* 17**,** 475-482.

TUGWELL, P., BENNETT, K. J., SACKETT, D. L. & HAYNES, R. B. 1985. The measurement iterative loop: a framework for the critical appraisal of need, benefits and costs of health interventions. *Journal of chronic diseases,* 38**,** 339-351.

UEGAKI, K., DE BRUIJNE, M. C., VAN DER BEEK, A. J., VAN MECHELEN, W. & VAN TULDER, M. W. 2011. Economic Evaluations of Occupational Health Interventions from a Company's Perspective: A Systematic Review of Methods to Estimate the Cost of Health-Related Productivity Loss. *Journal of Occupational Rehabilitation,* 21**,** 90-99.

UNIVERSITY OF YORK Database of Abstracts of Reviews of Effects. Available at http://www.crd.york.ac.uk/crdweb/ Accessed October 2011.

VAN DONGEN, J. M., PROPER, K. I., VAN WIER, M. F., VAN DER BEEK, A. J., BONGERS, P. M., VAN MECHELEN, W. & VAN TULDER, M. W. 2011. Systematic review on the financial return of worksite health promotion programmes aimed at improving nutrition and/or increasing physical activity. *Obes Rev,* 12**,** 1031-49.

VAN DONGEN, J. M., VAN WIER, M. F., TOMPA, E., BONGERS, P. M., VAN DER BEEK, A. J., VAN TULDER, M. W. & BOSMANS, J. E. 2014. Trial-based economic evaluations in occupational health: principles, methods, and recommendations. *Journal of Occupational and Environmental Medicine,* 56**,** 563-72.

WALTERS, S. J. & BRAZIER, J. E. 2003. What is the relationship between the minimally important difference and health state utility values? The case of the SF-6D. *Health and quality of life outcomes,* 1**,** 4.

WALTERS, S. J. & BRAZIER, J. E. 2005. Comparison of the minimally important difference for two health state utility measures: EQ-5D and SF-6D. *Qual Life Res,* 14**,** 1523-32.

WANG, S., MOSS, J. R. & HILLER, J. E. 2006. Applicability and transferability of interventions in evidence-based public health. *Health Promotion International,* 21**,** 76-83.

WARE JR, J. E., KOSINSKI, M. & KELLER, S. D. 1996. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Medical care,* 34**,** 220-233.

WARE JR, J. E. & SHERBOURNE, C. D. 1992. The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Medical care,* 30**,** 473-483.

WARNER, K. E., WICKIZER, T. M., WOLFE, R. A., SCHILDROTH, J. E. & SAMUELSON, M. H. 1988. Economic implications of workplace health promotion programs: review of the literature. *J Occup Med,* 30**,** 106-12.

WATSON, N. & WOODEN, M. 2004. The HILDA Survey four years on. *Australian Economic Review,* 37**,** 343-349.

WATSON, W. L., OZANNE-SMITH, J. & RICHARDSON, J. 2005. An evaluation of the assessment of quality of life utility instrument as a measure of the impact of injury on health-related quality of life. *International Journal of Injury Control and Safety Promotion,* 12**,** 227-239.

WEF WORLD ECONOMIC FORUM Workplace Wellness App developed by Boston Consulting Group, available at http://wellness.weforum.org/model.

WEINER, B. J., LEWIS, M. A. & LINNAN, L. A. 2009. Using organization theory to understand the determinants of effective implementation of worksite health promotion programs. *Health Educ Res,* 24**,** 292-305.

WEINSTEIN, M. C., SIEGEL, J. E., GOLD, M. R., KAMLET, M. S. & RUSSELL, L. B. 1996. Recommendations of the Panel on Cost-effectiveness in Health and Medicine. *JAMA,* 276**,** 1253-8.

WENZEL, E. 1994. *Chapter 15 Conceptual issues in worksite health promotion; in Ecological public health: from vision to practice*, Centre for Health Promotion, University of Toronto: ParticipACTION.

WHITELAW, S., BAXENDALE, A., BRYCE, C., MACHARDY, L., YOUNG, I. & WITNEY, E. 2001. 'Settings' based health promotion: a review. *Health Promot Int,* 16**,** 339-53.

WHO GLOBAL PLAN OF ACTION ON WORKERS' HEALTH (2008-2017) Available at http://apps.who.int/gb/ebwha/pdf_files/WHA60/A60_R26-en.pdf.

WILLIAMS, A. 1987. Health Economics: the cheerful face of a dismal science. *In:* WILLIAMS, A. (ed.) *Health and Economics.* London: Macmillan.

WILLIDEN, M., SCHOFIELD, G. & DUNCAN, S. 2012. Establishing links between health and productivity in the New Zealand workforce. *J Occup Environ Med,* 54**,** 545-50.

WINDSOR, R. A. & LOWE, J. B. 1989. Behavioral impact and cost analysis of a worksite self-help smoking cessation program. *Progress in clinical and biological research,* 293**,** 231-242.

WONDERLING, D. G., R. AND BLACK, N., 2005. *Introduction to Health Economics in Understanding Public Health: London School of Hygiene & Tropical Medicine*, Open University Press McGraw-Hill Education.

WOOD, E. A., OLMSTEAD, G. W. & CRAIG, J. L. 1989. An evaluation of lifestyle risk factors and absenteeism after two years in a worksite health promotion program. *American journal of health promotion,* 4**,** 128-133.

WOODEN, M. & WATSON, N. 2007. The HILDA Survey and its Contribution to Economic and Social Research (So Far)*. *Economic Record,* 83**,** 208-231.

WORKPLACE HEALTH AND SAFETY QUEENSLAND 2008. Healthy Lifestyle Program for the Queensland Public Service: Guidelines for government agencies. Available at www.worksafe.qld.gov.au Accessed on August 2014.

WORKSAFE TASMANIA available at www.worksafe.tas.gov.au/industry_and_safety/health_and_wellbeing/simple_guide_resources Accessed on 17 March, 2015.

WORLD BANK 2001. Health Systems Development. Health Economics Available at http://www.worldbank.org/en/topic/health.

WORLD ECONOMIC FORUM 2010. The New Discipline of Workforce Wellness *Enhancing Corportae Performance by Tackling Chronic Disease*.

WORLD HEALTH ORGANIZATION - REGIONAL OFFICE FOR THE WESTERN PACIFIC 1999. Regional guidelines for the development of health workplaces Available at www.wpro.who.int Accessed June 2013.

WORLD HEALTH ORGANIZATION 1986. Ottawa Charter for Health Promotion. Available at http://www.who.int/healthpromotion/conferences/previous/ottawa/en/ Accessed Sept 2012.

WORLD HEALTH ORGANIZATION. 1997a. *Jakarta Declaration on Leading Health Promotion into the 21st Century. Available at http://www.who.int/healthpromotion/conferences/previous/jakarta/declaration/en/ Accessed on May 2015* [Online].

WORLD HEALTH ORGANIZATION 1997b. Jakarta Statement on Healthy Workplaces. Available at http://www.who.int/healthpromotion/conferences/previous/jakarta/statements/workplaces/en/ Accessed on June 2013.

WORLD HEALTH ORGANIZATION 1997c. WHO's Global Healthy Work Approach; Document (HPR/HEP/97.2). *In:* DIVISION OF HEALTH PROMOTION, E. A. C. A. O. O. O. H. (ed.). Geneva.

WORLD HEALTH ORGANIZATION 1998. Health Promotion Glossary. *Division of Health Promotion, Education and Communications (HPR), Health Educations and Health Promtoion Unit (HEP) WHO/HPR/HEP/98.1*

WORLD HEALTH ORGANIZATION. 2001. *Evaluation in Health Promotion; Principles and Perspectives. WHO Regional Publications, European Series, No 92 Available at http://www.euro.who.int/en/publications/abstracts/evaluation-in-health-promotion.-principles-and-perspectives Accessed on May 2013* [Online].

WORLD HEALTH ORGANIZATION 2008. Commission on Social Determinants of Health - final report. Closing the gap in a generation: Health equity through action on the social determinants of health. Available at http://www.who.int/social_determinants/thecommission/finalreport/en/ Geneva.

WORLD HEALTH ORGANIZATION 2009. Milestones in Health Promotion; Statements from Global Conferences. WHO/NMH/CHP/09.01 Available at http://www.who.int/healthpromotion/Milestones_Health_Promotion_05022010.pdf?ua=1 Accesed on May 2015.

WORLD HEALTH ORGANIZATION 2015. Global Health Observatory (GHO) data: World Health Statistics Part II Global health Indicators. Available at http://who.int/gho/publications/world_health_statistics/2015/en/ Accessed June 2015.

YEN, L., SCHULTZ, A. B., SCHAEFER, C., BLOOMBERG, S. & EDINGTON, D. W. 2010. Long-term return on investment of an employee health enhancement program at a Midwest utility company from 1999 to 2007. *International Journal of Workplace Health Management,* 3**,** 79-96.

ZARNKE, K. B., LEVINE, M. A. & O'BRIEN, B. J. 1997. Cost-benefit analyses in the health-care literature: don't judge a study by its label. *J Clin Epidemiol,* 50**,** 813-22.

ZHANG, W., BANSBACK, N. & ANIS, A. H. 2011. Measuring and valuing productivity loss due to poor health: A critical review. *Soc Sci Med,* 72**,** 185-92.